CWA BIOSOLIDS INSPECTION REPORT
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 5

Purpose: Clean Water Act Biosolids Inspection – Milorganite® Biosolids Process

Facility: Milwaukee Metro Sewerage District (MMSD), Jones Island Biosolids Dewatering and Drying Facility

NPDES Permit Number: WI-0036820-03

Date of Inspection: March 14, 2017

MMSD Representative:
Mr. Tom Nowicki, Attorney; (414) 225-2243

Report Prepared by:
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EPA Inspector Signature: _____

Report Date: 4/25/17

Approver Name & Title:
Ryan Bahr, Chief, Compliance Section 2

Approver Signature _____

Approval Date: 4/26/17

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I. INTRODUCTION

The State of Delaware recently contacted EPA to express concerns regarding the Milwaukee Metro Sewerage District's (MMSD) ability to meet Title 40 of the Code of Federal Regulations, Part 503 (*The Standards for the Use and Disposal of Sewage Sludge*), heat drying requirements for Exceptional Quality (EQ) biosolids. EPA's Part 503 regulations were designed to prevent humans and animals from direct or indirect contact with pathogens found in sewage sludge. On March 14, 2017, the United States Environmental Protection Agency (EPA) Region 5, with support from EPA's Office of Research and Development (ORD), and EPA Region 7 (collectively, the EPA Inspection Team), conducted a biosolids inspection at the Milwaukee Metro Sewerage District Combined's (MMSD), Jones Island EQ Biosolids Dewatering and Drying Facility (hereinafter, D&D Facility). The D&D Facility is owned and operated by MMSD. Veolia Water Milwaukee, LLC, provides operational management and support for production of EQ biosolids at the D&D Facility. MMSD sells and distributes processed biosolids as EQ biosolids under the product name "Milorganite®". Once biosolids meet EQ requirements they generally are not subject to further regulation under 40 CFR 503. As a result, 40 CFR 503 regulations include monitoring requirements to ensure EQ biosolids are safe for distribution to the public.

EPA assessed MMSD's compliance with 40 CFR Part 503 and the National Pollutant Discharge Elimination System (NPDES) permit for the D&D Facility. The inspection consisted of the following major activities:

- Inspection opening conference;
- Discussion/Interview with representatives from the D&D Facility. Starting with Facility presentation on the Milorganite® Heat Drying Process. Covered recordkeeping, sludge process evaluation, laboratory, and sludge sampling and analysis;
- Physical inspection of the D&D Facility; and
- Closing conference and areas of concern review.

This report summarizes the results of the inspection. The following personnel were involved in the inspection of the D&D Facility:

MMSD:	Sid Arora, Contract Compliance Assistant Manager Tom Nowicki, Staff Attorney Patrick Obenauf, Contract Compliance Manager Alfredo Sotomayor, Laboratory Manager Steve Unger, Contract Administrator
Veolia Water Milwaukee:	Jake Holbert, Dewatering and Drying Manager Scott Royer, General Manager Todd Schwingle, Operations Manager
EPA Region 5:	Dean Maraldo, Inspector/Enforcement Officer John Colletti, NPDES Permits Program
EPA Region 7:	Scott Postma, Inspector
EPA ORD:	Laura Boczek, Microbiologist Jim Smith, Engineer

Wisconsin DNR:	Frederick Hegeman, Wastewater Engineer Bryan Hartsook, Wastewater Supervisor

II. BACKGROUND

MMSD is authorized to discharge treated wastewater from the Jones Island Water Reclamation Facility to Lake Michigan, Milwaukee Harbor, and tributary streams in Milwaukee County under NPDES permit number WI-0036820-03 (hereinafter, Permit). The Permit also includes land application requirements for EQ biosolids produced at the D&D Facility. The Facility's Operations Department is responsible for operating the D&D Facility and for compliance with the Permit. MMSD is responsible for conducting monitoring activities and reporting monitoring results to the Wisconsin Department of Natural Resources (WDNR) and EPA. Currently, the Operations Department has 22 employees responsible for the operation and maintenance of the D&D Facility. The operators' duties include operation and maintenance (O&M) of the dewatering and drying process, silo operations, process and compliance monitoring, and overall process control. The D&D Facility operates 350 days per year.

MMSD's Jones Island Water Reclamation Facility (JIWRF) began operating in 1925, and has a current design capacity of 330 MGD. MMSD began producing Milorganite® at the JIWR Facility in 1926. The current sludge D&D Facility has been in operation since 1994 and is located within the JIWR Facility. The D&D Facility treats sludge from the JIWR Facility and MMSD's South Shore Water Reclamation Facility. Milorganite® is produced at the D&D Facility from sludge collected at the two facilities. Milorganite® is marketed as a commercial fertilizer and sold in bags at retail stores or shipped via rail and truck to commercial customers in the USA, Canada, and elsewhere.

III. INSPECTION ACTIVITY SUMMARY

III. A. Opening Conference

The inspection opening conference began with introductions at 9:02 am on March 14, 2017, at the Jones Island Water Reclamation Facility office. I presented my EPA-issued Enforcement Officer Credentials, and Mr. Scott Postma presented his EPA Inspector Credentials to Mr. Tom Nowicki, staff attorney and primary facility contact for MMSD-Milorganite®. I discussed the intent and scope of the inspection. I explained the permittee's rights to claim material as confidential. Mr. Nowicki confirmed that MMSD would make no confidential information claims as part of the inspection. Mr. Nowicki also provided copies of material I requested prior to the inspection, including 2016 dryer temperature records, organizational charts, current NPDES permit, and annual biosolids reports (2014-2016). The group discussed the schedule for the day and agreed to move on to the Facility-led presentation on the Milorganite® Heat Drying Process.

III. B. Discussion/Interview

Facility Presentation on the Milorganite® Heat Drying Process: Mr. Nowicki began the Facility's presentation on the Milorganite® Heat Drying Process with an overview of MMSD's water reclamation facilities and the history of Milorganite® production. A copy of the presentation slides, including detailed process diagrams and figures, is included in Appendix B of this report. During the presentation Mr. Nowicki mentioned that Milorganite® is bagged on Jones Island by a contractor and sold at retail locations throughout the United States. He also mentioned that some Milorganite® is transported from the

Facility to customers via rail and truck, and in one case shipped overseas. Mr. Nowicki also acknowledged the concerns expressed by Delaware and Maryland regarding MMSD's ability to meet 40 CFR part 503 heat drying requirements. Mr. Nowicki concluded his portion of the presentation by stating any heat drying concerns are addressed by "massive amounts of recycling."

Mr. Nowicki introduced Sid Arora, MMSD's Contract Compliance Assistant Manager, who presented slides covering the Milorganite® heat drying process. Mr. Arora described the Milorganite® process which begins with sludge transport from MMSD's South Shore Water Reclamation Facility (SSWRF), via pipeline, and JIWRF, via conveyor, to the D&D Facility at Jones Island. He explained how waste activated and digested sludge is transported from SSWRF and how waste activated sludge is conveyed from JIWRF. Mr. Arora mentioned that the D&D Facility processes approximately 150 dry tons of solids per day. Approximately 130 dry tons are converted into the Milorganite® product daily and stored in silos near the D&D building. Dust and chaff from the classification process results in daily landfill average of 10 to 15 dry tons per day. He then described the sludge treatment process at the D&D Facility which begins with blending at the equalization and blending tanks. Mr. Arora pointed out that MMSD tries to maintain a solids content 3.25% for blended sludge, which then goes through one of the 24 belt filter presses creating a filter cake of approximately 18% solids. Mr. Arora then described the 12 sludge rotary dryers and the drying process. According to Mr. Arora, the wet filter cake contacts hot gases in the dryers resulting in a product of approximately 94% solids. On average, eight dryers are in service each day. He discussed how the heated product goes through a "classification" step after drying to sort out the finished material (typically 130 tons/day to one of the 14 storage silos), from oversized material which gets recycled into mills and back to dryers, and dust and chaff which is transported to landfill. Mr. Arora then described how the finished Milorganite® material is loaded out to the bagging facility on Jones Island, or shipped directly to customers via rail or truck. The Milorganite® process is summarized in Figure 1, below.

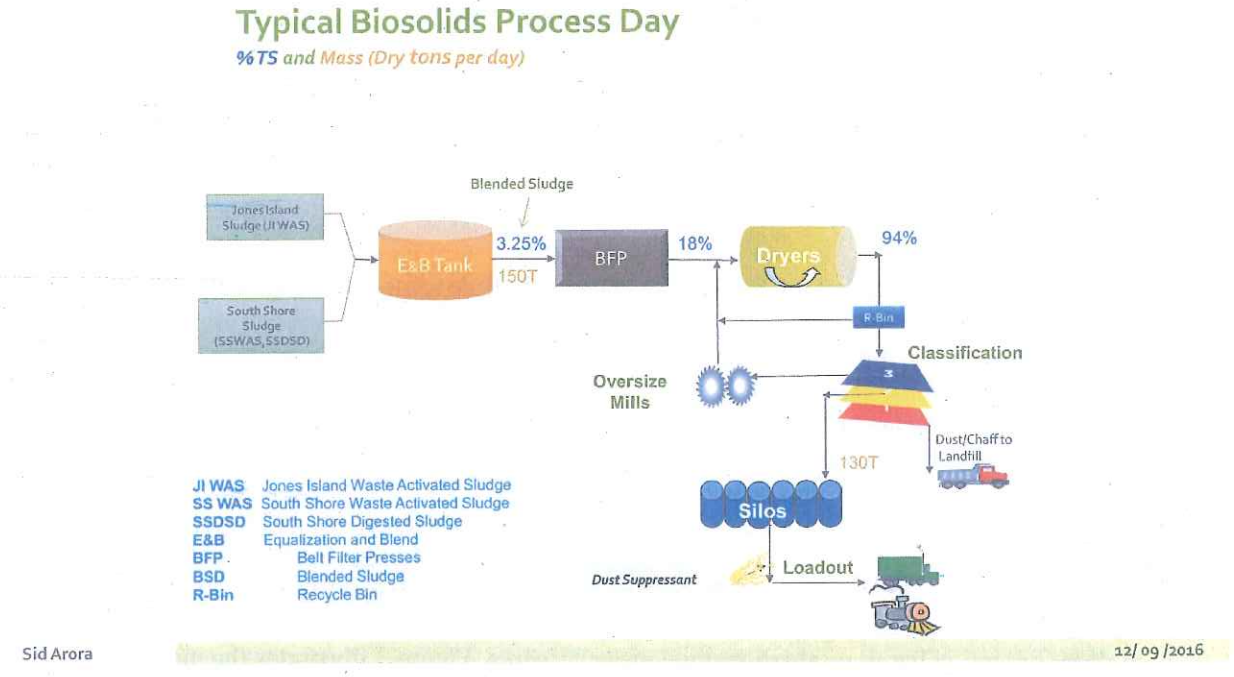


Figure 1. Typical Biosolids Process Day. (Slide presented during inspection by Mr. Sid Arora, MMSD)

Mr. Arora then focused the presentation on the dryer product temperature measurement issue. He described a recent MMSD study, based on 2015 data, concluding that 99.9% of the dryer product leaves the heat drying system with temperature > 176 degrees F. The conclusion was based on a statistical analysis of the estimated amount of product receiving only a single pass through a dryer, and the percentage of dryer temperature measurements below 176 degrees F. Mr. Pat Obenauf, Contract Compliance Manager, added that "particles can go through recycling six times." The probability analysis is summarized in Figure 2, below.

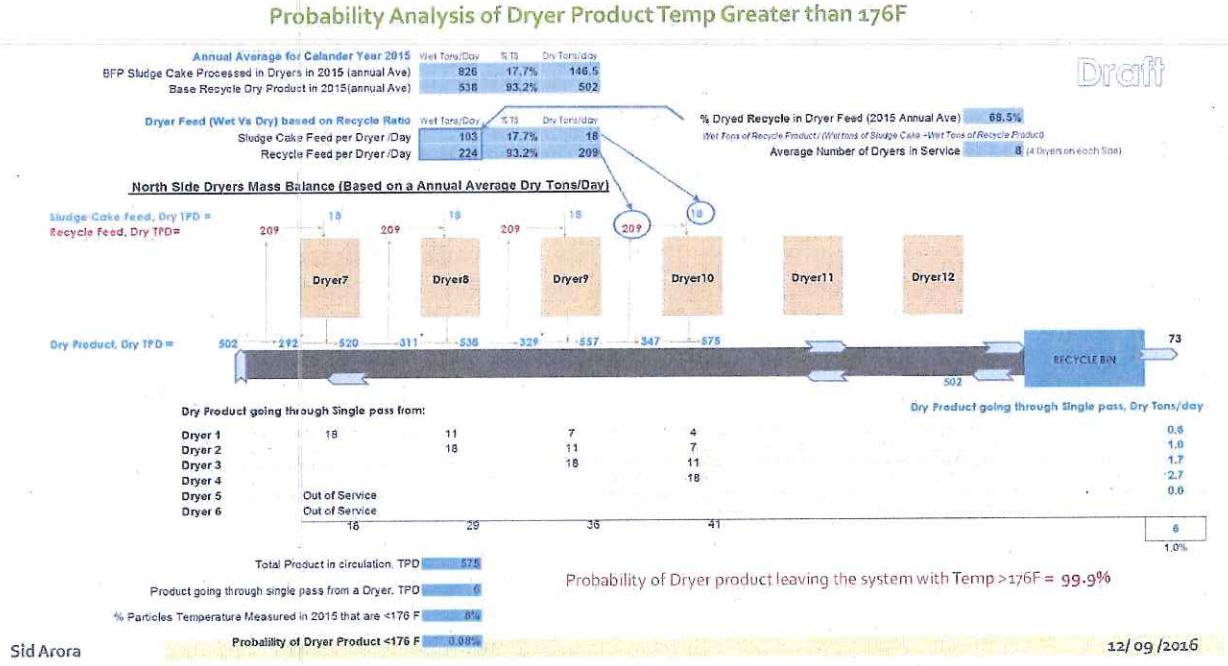


Figure 2. Probability Analysis of Dryer Temp Greater than 176 Degrees F. (Slide presented during inspection by Mr. Sid Arora, MMSD)

Mr. Arora went over the applicable 40 CFR Part 503 Biosolids Rule (Appendix B (B)(2)) requirement for Heat Drying which states:

> *Sewage sludge is dried by direct contact or indirect contact with hot gasses to reduce the moisture content of the sewage sludge to 10 percent or lower. Either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.*

Mr. Arora went on to explain MMSD's recent pilot program, as of February 16, 2017, to manually record dryer temperatures to support demonstration of compliance with heat drying standard. If dryer product temperature measurements show less than 176 degrees F at the current dryer discharge screw chute (19' away from dryer outlet), operators would measure temperatures manually using an infrared gun and make changes to dryer operation based on these manual measurements. Figure 3 illustrates the monitoring scheme for the pilot, including a diagram of a dryer furnace, current product temperature measurement location along the dryer discharge screw (identified as location "C"), and the pilot air temperature measurement location within the dryer furnace (identified as location "A").

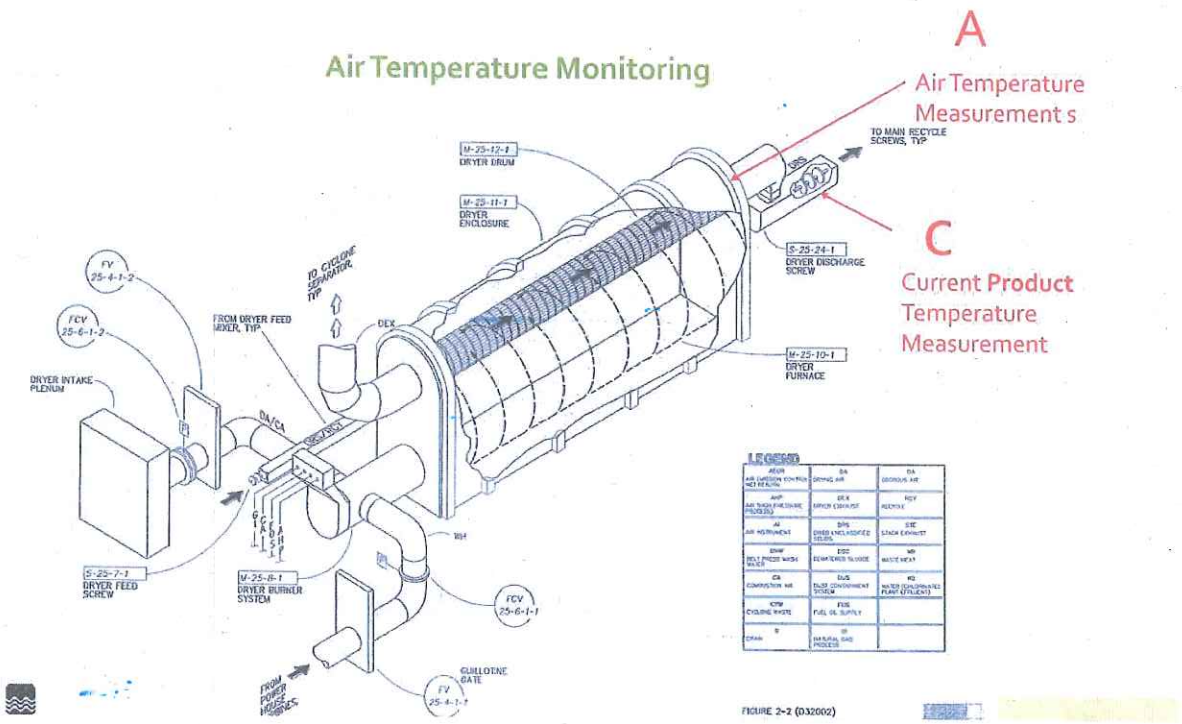


Figure 3. Summary of Air Temperature Pilot Monitoring Locations. (Slide presented during inspection by Mr. Sid Arora, MMSD). Note distance between points A and C is 19 feet.

Mr. Arora concluded the presentation on the pilot program by summarizing the results. He mentioned that cooling starts immediately downstream of the dry furnaces with an average temperature drop of 52 degrees F between the air temperature at the dryer furnace outlet and the existing air temperature monitoring location along the outside of the dryer discharge screw housing. Figures 4 and 5 summarize the results of the pilot.

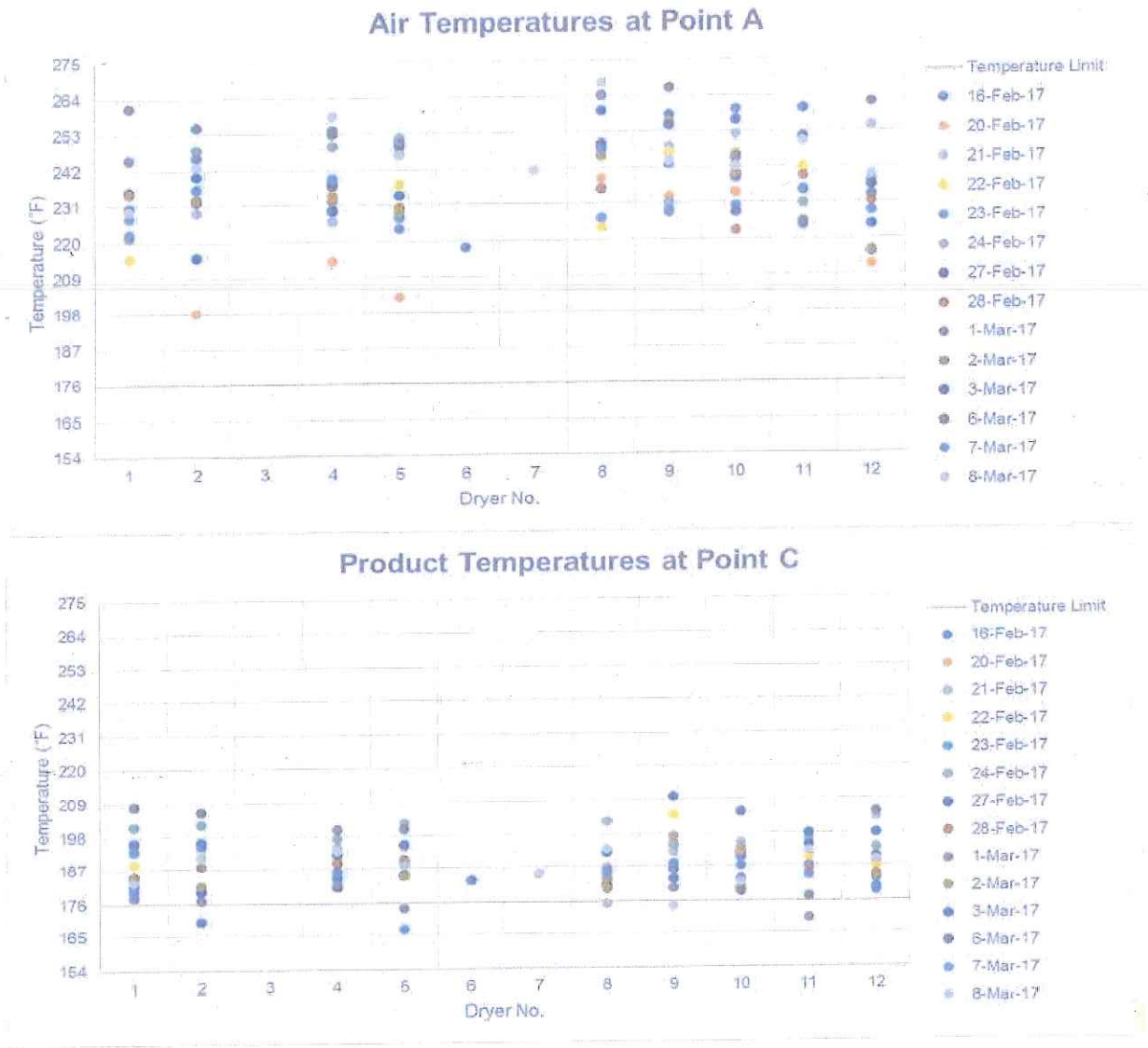


Figure 4. Summary of Air Temperature Pilot Monitoring Data. (Slide presented during inspection by Mr. Sid Arora, MMSD).

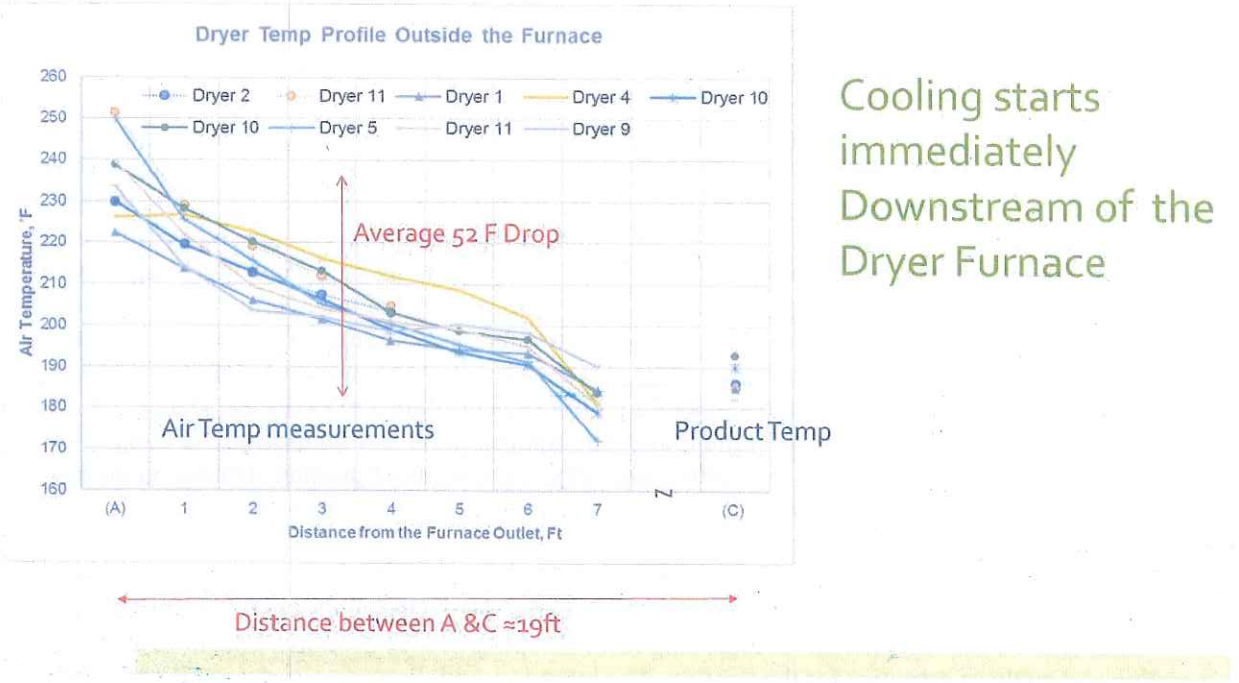


Figure 5. Results of Air Temperature Monitoring Pilot. (Slide presented during inspection by Mr. Sid Arora, MMSD).

Mr. Arora then discussed the Milorganite® process control sampling program and summarized moisture and fecal coliform data from 2013 - present. According to the data presented by Mr. Arora, results of fecal coliform samples of Milorganite® product have not exceeded the 40 CFR Part 503.32 (a) (7) limit of 1,000 MPN, and in almost cases are below the level of detection. Mr. Arora mentioned that the fecal coliform samples are collected three times per month from finished product and prior to transport to the day tanks and silos. Mr. Arora also shared the results of a recent effort to collect Milorganite® fecal coliform samples prior to load out. MMSD collected three fecal coliform samples at load out in February and March 2017. According to Mr. Arora, the results ranged from below detection limit to 8.67 MPN/gTS. Moisture samples are collected as product is loaded out after temporary storage in silos. He also said that solids are stored in silos for 14 days prior to bagging or shipping.

Mr. Arora then presented a slide explaining why MMSD's heat drying data indicate some product temperatures less than 176 degrees F (80 degrees Celsius). Reasons presented by Mr. Arora included:

- MMSD measuring temperature ~19 feet away from dryer furnace outlet along dryer discharge screw chute. Product starts cooling before reaching temperature probes. Mr. Arora also confirmed that the temperature probes measure the temperature of discharge screw housing, not the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with sewage sludge.
- Dryer could be operating in Add Back Mode.
- Dryer Discharge Screw has layer of product sticking on the bottom, thereby shielding the real temperatures. Mr. Arora did not provide any details or study results to confirm any potential temperature shielding effect from accumulated product on bottom of chute.

I asked for an explanation of what happens, in terms of operational protocols, when temperature probes indicate temperatures below 176 degrees F. Mr. Arora indicated that over the past three years operators

used a manual IR gun to confirm dryer air temperatures. I asked if these manual measurements were recorded. Mr. Jacob Holbert, D&D Manager, confirmed that manual IR measurements of dryer gas were not recorded until recently. I requested copies of any recent manual temperature measurements.

As discussed above, 40 CFR Part 503 (Appendix B (B)(2)) requires *either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.* MMSD's WPDES Permit, Part 10.6.12 includes the same Heat Drying Process requirements. As indicated by Mr. Arora, MMSD has not measured the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with sewage sludge. Instead MMSD measures temperature approximately 19 feet away from the dryer furnace outlet along dryer discharge screw chute. In addition, he confirmed that the temperature probes measure the temperature of discharge screw housing, not the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with sewage sludge. Mr. Arora also mentioned that instrument (probe) failure may be responsible for low temperature readings. The shielding of real temperatures in the dryer discharge screw, as a result of product sticking on the bottom, and instrument failure further contribute to the uncertainty regarding air temperatures and indicate an ongoing compliance monitoring and maintenance issue.

After MMSD completed the presentation on the Milorganite® Heat Drying Process, I began to interview the MMSD and Veolia representatives regarding recordkeeping, sludge process evaluation, and sludge sampling and analysis activities for the Facility. The interview and discussion summary is provided below.

Recordkeeping:
Mr. Nowicki confirmed that MMSD is responsible for ensuring compliance with EPA's 503 and Biosolids regulation. He also mentioned that Veolia collects samples and develops annual reports for Wisconsin, but MMSD handles all other reporting requirements related to Milorganite®. I asked why the WPDES permit requires annual sampling for fecal coliform when, according to 40 CFR Part 503.16 (a), MMSD should be collecting monthly samples. Mr. Fred Hegeman, WDNR wastewater engineer, explained that this was a requirement under Wisconsin rule NR 204. Mr. Bryan Hartsook, WDNR wastewater supervisor, said that he would review the issue as part of the next permit renewal cycle. Despite the annual fecal coliform monitoring requirement in the permit, MMSD collects three fecal coliform samples per month. Finally, I asked the group if there were any known compliance issues over the past two years, aside from the air temperature monitoring issues discussed previously. Mr. Nowicki said that there were none.

Sludge Process Evaluation: I asked if the Facility has sludge processing back-up units and equipment. Mr. Steve Unger, Contract Administrator, indicated that there were redundancies built in to the process, and that the South Shore facility had capacity to store sludge. Mr. Unger added that late last year MMSD had to use the South Shore facility to store sludge, and through discussions among the group I learned that some sludge material may be approaching the regulatory two-year storage limit. According to 40 CFR Part 503.20(b), surface disposal requirements would apply in this situation unless *the person who prepares the sewage sludge demonstrates that the land on which the sewage sludge remains is not an active sewage sludge unit.*

Mr. Unger also mentioned that there were 14 sludge storage silos within the Facility which can store a total of 14,000 tons of product. Mr. Patrick Obenauf, Contract Compliance Manager, added that they typically limit capacity to 10,000 tons.

I asked if over the last two years MMSD had to remove final product from distribution due to failure to meet heat drying temperatures or percent moisture requirements. Mr. Unger confirmed that MMSD has not removed any final product from production within the last two years. He also mentioned that operators test dryer temperatures manually when temperature measured along the dryer screw chute are below 176 degrees F. He reiterated that operators are now recording this information.

I asked MMSD to confirm the methods used to meet 40 CFR Part 503 Class A Biosolids requirements. Mr. Nowicki confirmed that MMSD uses Class A - Alternative 5 (Part 503.32(a)(7)) to meet pathogen reduction evaluation requirements. This alternative states that sewage sludge is considered to be Class A if:

- It has been treated in one of the Processes to Further Reduce Pathogens (PFRPs) listed in Appendix B of 40 CFR Part 503, and

- Either the density of fecal coliforms in the sewage sludge is less than 1,000 MPN per gram total solids (dry weight basis), or the density of Salmonella sp. bacteria in the sewage sludge is less than 3 MPN per 4 grams total solids (dry weight basis) at the time the sewage sludge is used or disposed, at the time the sewage sludge is prepared for sale or give away in a bag or other container for land application, or at the time the sewage sludge or material derived from the sewage sludge is prepared to meet the requirements in 503.10(b), 503.10(c), 503.10(e), or 503.10(f).

Mr. Nowicki confirmed that MMSD uses the PFRP Heat Drying method (Appendix B of 40 CFR Part 503(B)(2)). The method states that Sewage sludge is dried by direct contact or indirect contact with hot gasses to reduce the moisture content of the sewage sludge to 10 percent or lower. Either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.

Mr. Nowicki also verified that MMSD uses Option 8 (Part 503.33(b)(8)) to meet pathogen vector attraction reduction requirements. Under this option, vector attraction of any sewage sludge is considered to be reduced if the solids content of the sewage sludge is increased to 90% or greater.

Laboratory:

I began the laboratory portion of the interview by going over general laboratory procedures and confirming methods used to analyze fecal coliform and percent solids. Mr. Alfredo Sotomayor, Laboratory Manager, confirmed that EPA Method 1680 was used for fecal coliform. He believed Standard Method 2540G was used for percent solids but was not sure. I later confirmed this while reviewing MMSD's Milorganite® 2016 Annual Report. I asked Mr. Sotomayor to describe the process used to analyze fecal coliform samples. He said the process involved collection of three grab samples of final product per month. Mr. Sotomayor indicated that samples were typically stored at room temperature until the end of the month when all three samples are analyzed at the same time. I asked Mr. Sotomayor to explain why the fecal coliform samples were not refrigerated and not analyzed within the standard holding time of 8 hours pursuant to EPA 1680. He stated that this "process has been going on for as long as I can remember."

I asked Mr. Sotomayor to provide examples of laboratory bench sheets used for fecal coliform. He provided a set of recent bench sheets. I noticed that sample time is not included on the bench sheet. I mentioned to Mr. Sotomayor that without sample time, compliance with fecal coliform holding times cannot be verified.

I asked Mr. Sotomayor if MMSD had a laboratory QA/QC manual and how often it was updated. He said they did and updates occur annually. He also mentioned that MMSD has updated standard operating procedures for methods and equipment. I did not conduct an audit of the laboratory during this inspection.

Sludge Sampling:
This portion of the interview focused on the sludge sampling issue. As discussed earlier during the Facility presentation on the Milorganite® Heat Drying Process, fecal coliform samples are collected three times per month from finished product and prior to transport to the day tanks and silos. Moisture samples are collected as product is loaded out after temporary storage in silos. Mr. Jim Smith, EPA ORD Engineer, pointed out the requirement in 40 CFR Part 503.32(a)(7)) to collect fecal coliform samples *at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in §503.10(b), (c), (e), or (f).* Mr. Unger confirmed that fecal coliform samples are collected from the distribution pile, not at the point of bagging or at the time of load out into train or trucks for offsite shipping.

The EPA Inspection Team concluded the Discussion/Interview portion of the inspection at noon.

III. C. Physical Facility Inspection – D&D Facility

The EPA Inspection Team toured the D&D Facility between 12:35 pm and 2:15 pm. Photos referenced below are included in the Photo Log (Appendix C). Mr. Arora led the tour, along with a number of MMSD and Veolia personnel. The inspection followed the treatment process including the equalization and blending tanks, belt filter presses, and the 12 sludge rotary dryers. Photograph 1 (RIMG0136) provides a view of six of the 12 sludge rotary dryers which heat the wet filter cake. Mr. Arora confirmed that on average eight dryers are in service each day. Mr. Arora explained that the air is heated in the dryer to temperatures of approximately 800 degrees F. The outlet end of the dryer is captured in Photograph 2 (RIMG0139). The heat-processed material drops out of the dryers through the chute shown in Photograph 3 (RIMG0140). The material drops down the chute into a dryer discharge screw chute, shown in Photograph 4 (RIMG0149). The two temperature probes used by MMSD to monitor heat drying temperatures are located on the dryer discharge screw chute at the location shown in Photograph 4. Mr. Arora reiterated that this temperature monitoring location is 19 feet away from the dryer outlet. He also confirmed that the probes measure the temperature of the outer chute casing, not the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with sewage sludge as required under 40 CFR Part 503 (Appendix B (B)(2)) and WPDES Permit, Part 10.6.12. The probe temperatures at the time of inspection measured 196.9 and 195.2 degrees F. Prior to leaving the dryer area Mr. Arora offered to have an operator demonstrate the manual dryer gas temperature measurement process currently being tested by MMSD. Photograph 5 (RIMG0147) shows the operator inserting the temperature probe into the dryer outlet access door.

Mr. Arora then led the group to the screen room where the final product is sorted from chaff and dust (Photograph 6 - RIMG0154). He described the "classification" step which sorts out the finished material (typically 130 tons/day to one of the 14 storage silos), from oversized material which gets recycled into mills and back to dryers, and dust and chaff which is transported to landfill. Next, we observed the final Milorganite® product sampler location (Photograph 7 – RIMG0155), and final Milorganite® product (Photograph 8 – RIMG0156).

Completing the inspection of the D&D building, Mr. Arora led the group past the silos to the load out facility. On the second floor of the load out facility we observed the belt conveyer which transports product from the silos to the load out facility. The belt conveyor, dust suppression port, and product auto sampler are shown in Photograph 9 (RIMG0157). Mr. Arora discussed how the finished Milorganite® material is loaded out to the bagging facility on Jones Island, or shipped directly to customers via rail or truck.

EPA completed the D&D Facility physical inspection at 2:15 pm.

IV. CLOSING CONFERENCE

I began the closing conference at the Jones Island Water Reclamation Facility office at 2:48 pm, and briefly identified potential areas of concern with the MMSD and Veolia representatives. The potential areas of concern included:

- Heat drying temperature monitoring issues.
- Location of compliance sampling for fecal coliform and moisture content.
- Fecal coliform sample preservation and holding time issues. Sample collection times not included on chain of custodies and lab bench sheets.
- Long-term storage of cake solids at South Shore facility.

I mentioned that the areas of concern were preliminary and additional areas of concern may be identified after review of information collected during the inspection. After sharing the potential areas of concern, I asked the group if they had any questions. Mr. Unger asked a clarifying question regarding the long-term storage of cake solids at the South Shore facility.

Mr. Obenauf asked for guidance on temperature dryer temperature monitoring, specifically about ideas for frequency of monitoring of dryer temperatures. Mr. Smith suggested MMSD consider processing time of material through the dryers. For example, if material takes 30 minutes to run through a dryer, 30 minutes may be an appropriate temperature monitoring interval. There was a general discussion about the difficulties in monitoring both temperature and moisture within the dryers.

I provided the group with an estimated timeframe for completion of the inspection report and we concluded the closing conference at 3:30 pm. The EPA Team departed the Facility at 3:40 pm on March 14, 2017.

V. DOCUMENTS RECEIVED

Documents received during the inspection:

- Copy of presentation on Milorganite® Drying Process
- Record of dryer discharge IR temperature data, June 2016-Feb. 2017
- Organizational charts for MMSD and Veolia
- Milwaukee Metro Sewerage District NPDES Permit No. WI-0036820-03; issued by Wisconsin DNR; expiration date December 31, 2017.
- MMSD 2014, 2015, 2016 Milorganite® Annual Reports
- 2016 Dryer data
- 2016 Quarterly minute DTP data

- Bench sheets for bacteria and percent solids
- Effluent total residual chlorine data, Jones Island 2016, Jan-Feb 2017
- Chain of custodies, solids, metals, PCBs – Feb 2017
- Total residual chlorine SOP
- Total residual chlorine data 2016
- Polymer MSDS

Documents received after the inspection:

- Dust suppressant MSDS (via email from Mr. Nowicki, March 15, 2017)
- Record of dryer discharge temperature 2015-2016 (via email from Mr. Nowicki, March 17, 2017)
- Shipped Soil Moisture Data, 2016 (via email from Mr. Nowicki, March 17, 2017).

VI. DOCUMENT REVIEW

After the inspection, I reviewed MMSD's Milorganite® 2016 Annual Report, including analytical results for parameters included in Part 8.2.3 of the WPDES Permit covering MMSD's Milorganite® Outfall 006. Based on the review of the annual report, MMSD met all permit limits with the exception of % sludge moisture content. Reported moisture content results for eight days throughout the year did not meet the vector attraction limit of >90% total solids, and heat drying limit requiring a moisture content of 10% or lower. The dates and results are provided below:

Sample Date	Result: % Sludge Moisture Content (Limit 10% or lower)
2/1/16	12%
6/16/16	12%
6/9/16	11%
11/17/16	12%
11/19/16	12%
12/9/16	11%
12/10/16	13%
12/31/16	11%

On March 17, 2017, I sent an email to Mr. Nowicki asking for clarification on what actions are taken when product moisture content is above 10% on a given day. I also asked if product generated on days where moisture limits are not met receive additional treatment or distributed as is. He provided clarification that MMSD mixes product from many days in silos before shipping and analyzes moisture a second time when loading shipments. He provided results of product moisture content at time of shipping for 2016. All results were within limits (<=10% moisture content). The shipped moisture content data did not appear to be included in MMSD's Milorganite® 2016 Annual Report.

I also reviewed hourly dryer discharge temperature data for October, November, and December 2016. For each day where MMSD reported temperature data, at least one dryer was reportedly operating below the 176 degree F limit for at least one hourly reporting period. WPDES Permit, Part 10.6.12 and 40 CFR

Part 503 (Appendix B (B)(2)) require *either the temperature of the sewage sludge particles exceeds 80 degrees Celsius [176 degrees F] or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius*. MMSD's WPDES Permit, Part 10.6.12.

Further, on many days, the dryer discharge temperatures for at least half of the dryers in operation were below the 176 degree F limit for at least one hour. For example, on December 6, 2016, MMSD dryer discharge data indicated that at least half of the dryers were operating below the 176 degree F limit for approximately 15 hours. See Figure 6 below for hourly dryer discharge temperatures for December 6, 2016.

	Dryer 1 Product Discharge Temp °F	Dryer 2 Product Discharge Temp °F	Dryer 3 Product Discharge Temp °F	Dryer 4 Product Discharge Temp °F	Dryer 5 Product Discharge Temp °F	Dryer 6 Product Discharge Temp °F	Dryer 7 Product Discharge Temp °F	Dryer 8 Product Discharge Temp °F	Dryer 9 Product Discharge Temp °F	Dryer 10 Product Discharge Temp °F	Dryer 11 Product Discharge Temp °F	Dryer 12 Product Discharge Temp °F
12/5/2016 21:00			188		179	181	183	187		191	188	
12/5/2016 22:00			176		177	177	180	189		187	184	
12/5/2016 23:00			172		170	164	179	183		180	180	
12/6/2016 0:00			170		170	166	173	177		174	171	
12/6/2016 1:00			170		170	166	173	177		174	171	
12/6/2016 2:00			174		183	175	169	171		168	168	
12/6/2016 3:00			181		185	182	178	175		172	177	
12/6/2016 4:00			185		181	189	179	181		184	183	
12/6/2016 5:00			179		170	182	168	168		163	169	
12/6/2016 6:00			179		170	182	168	168		163	169	
12/6/2016 7:00			180		180	179	176	176		181	178	
12/6/2016 8:00		190	179		169	175	181	177		180	177	
12/6/2016 9:00		182	171		167	167	171	167		174	175	
12/6/2016 10:00		182	171		167	167	171	167		174	175	
12/6/2016 11:00			177		173	178	174	186		177	176	
12/6/2016 12:00			172		141	175	168	165		179	177	
12/6/2016 13:00		170	175		138	172	174	174		173	174	
12/6/2016 14:00		183	168		159	175	181	181		178	177	
12/6/2016 15:00		183	168		159	175	181	181		178	177	
12/6/2016 16:00		177	175		173	176	174	175		170	170	
12/6/2016 17:00		182	177		172	177	177	176		170	176	
12/6/2016 18:00		186	180		170	174	177	175		179	176	
12/6/2016 19:00		186	173		176	175	176	175		180	176	
12/6/2016 20:00		185	171		174	174	175	175		167	175	
12/6/2016 21:00		182	172		174	174	175	175		171	170	
12/6/2016 22:00		182	177		175	172	175	175		174	173	
12/6/2016 23:00		181	168		172	172	177	176	185	176	160	

Figure 6. Hourly Dryer Product Discharge Temperatures for December 6, 2016 (provided by MMSD). Pink highlight indicate hours where temperatures are below 176 degrees F.

As discussed above in Section III.B., Mr. Arora described a recent MMSD study, based on 2015 data, concluding that 99.9% of the dryer product leaves the heat drying system with temperature > 176 degrees F. The conclusion was based on a statistical analysis of the estimated amount of product receiving only a single pass through a dryer, and the percentage of dryer temperature measurements below 176 degrees F. This analysis considers data for an entire year but does not consider individual days, like December 6, 2016, when dryer temperature data indicated that most of the dryer units were operating below 176 degrees F for most of the day.

VII. AREAS OF CONCERN

Based on the inspection findings and review of documents provided by MMSD, I identified several areas of concern. The areas of concern are summarized in the table below.

Area of Concern	Finding	Permit/Regulatory Reference
Heat drying temperatures	MMSD monitors neither the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryers. MMSD's heat drying data shows some product or gas temperatures less than 176 degrees F (80 degrees Celsius). MMSD believes 99.9% of the dryer product leaves the heat drying system with temperatures > 176 degrees F due to the recycling process. However, as indicated in Section 6 above, MMSD's probability analysis does not consider individual days, like December 6, 2016, when dryer temperature data indicated that most of the dryer units were operating below 176 degrees F for most of the day. 40 CFR Part 503.32 (a) and 40 CFR Part 503 (Appendix B (B)(2)) do not include the use of probability analysis to demonstrate compliance with Class A pathogen and vector attraction reduction requirements.	40 CFR Part 503.32 (a) (7) defines the option (Alternative 5) used by MMSD for meeting Class A pathogen reduction., including the requirement for sewage sludge that is used or disposed to be treated in one of the Processes to Further Reduce Pathogens described in 40 CFR Part 503 (Appendix B (B)(2)). 40 CFR Part 503 (Appendix B (B)(2)) requires *either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.* MMSD's WPDES Permit, Part 10.6.12
Location and Maintenance of Temperature Monitoring Probes	MMSD has not measured the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with sewage sludge. Instead MMSD measures temperature approximately 19 feet away from dryer furnace outlet along dryer discharge screw chute. The temperature probes measure the temperature of discharge screw housing, not the temperature of the sewage sludge particles or the wet bulb temperature of the gas in contact with sewage sludge.	40 CFR Part 503 (Appendix B (B)(2)) requires *either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.* MMSD's WPDES Permit, Part 10.6.12

Area of Concern	Finding	Permit/Regulatory Reference
	The potential shielding of real temperatures in the dryer discharge screw, as a result of product sticking on the bottom, and instrument (probe) failure further contribute to the uncertainty regarding air temperatures.	
Location of compliance sampling for fecal coliform and moisture content.	Moisture samples are collected as product is loaded out after temporary storage in silos, not at the point of bagging. Fecal coliform samples are collected from the distribution pile, not at the point of bagging or at the time of load out into train or trucks for offsite shipping.	*40 CFR Part 503.32(a)(7)* *Class A—Alternative 5. (i) Either the density of fecal…at the time the sewage sludge is used or disposed;* ***at the time the sewage sludge is prepared for sale or given away in a bag or other container*** *for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in §503.10(b), (c), (e), or (f).* *40 CFR Part 503.33(3). One of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8) shall be met* ***when sewage sludge is sold or given away in a bag or other container*** *for application to the land.* MMSD's WPDES Permit, Part 8.2.3.5 List 4. *Drying vector attraction requirements to be met "When applied or bagged."* *Control of Pathogens and Vector Attraction in Sewage Sludge (U.S. EPA, 2003)*. "Heat dried biosolids must be tested for fecal coliform or Salmonella sp. at the last point before being used or disposed. For example, biosolids should be tested immediately before they are bagged or before they leave the site for bulk distribution. If material is stored for a long period of time, it should be re-tested, even if previous testing has shown the biosolids to have met the Part 503 regulation."* *Control of Pathogens and Vector Attraction in Sewage Sludge (U.S. EPA, 2003)*. "Biosolids that meet the 503.10(b, c,d, or e) requirements are considered "Exceptional Quality" and*

Area of Concern	Finding	Permit/Regulatory Reference
		are therefore not subject to further control (see Section 1.4). For this reason, the microbiological requirements must be met at the time the biosolids are prepared to meet the 503.10 requirements, which in most cases is the last time the biosolids are under the control of a biosolids preparer."
Fecal coliform sample preservation and holding time issues.	Fecal coliform samples are stored at room temperature until the end of the month when all samples are analyzed at the same time. Fecal coliform samples are not refrigerated to <10°C and not analyzed within the standard holding time of 8 hours.	EPA Method 1680, adapted from method 9221 E. 40 CFR Part 503.8 (2).
Fecal Coliform sample collection times not included on chain of custodies and lab bench sheets.	Sample collection time is not included on the bench sheet for fecal coliform. Without sample time compliance with fecal coliform holding times cannot be verified.	EPA Method 1680, adapted from method 9221 E. 40 CFR Part 503.8 (2).
Exceedance of vector attraction limit of >90% total solids, and heat drying limit requiring a moisture content of 10% or lower.	Reported moisture content results for eight days in 2016 did not meet the vector attraction limit of >90% total solids, and heat drying limit requiring a moisture content of 10% or lower.	40 CFR Part 503 (Appendix B (B)(2)). 40 CFR Part 503.33(b)(8). MMSD's WPDES Permit, Part 8.2.3.5 List 3 and List 4.
Long-term storage of cake solids at South Shore facility.	Sludge material may be approaching the regulatory two-year storage limit for storage at the South Shore facility.	40 CFR Part 503.20(b). Surface disposal requirements do *not apply to sewage sludge that remains on the land for longer than two years when the person who prepares the sewage sludge demonstrates that the land on which the sewage sludge remains is not an active sewage sludge unit.*

* U.S. EPA publication# EPA/625/R-92/013, 2003

Appendix A: Aerial Image of MMSD Jones Island Facility

***Google Earth*® aerial image of the Facility, dated June 18, 2015.**

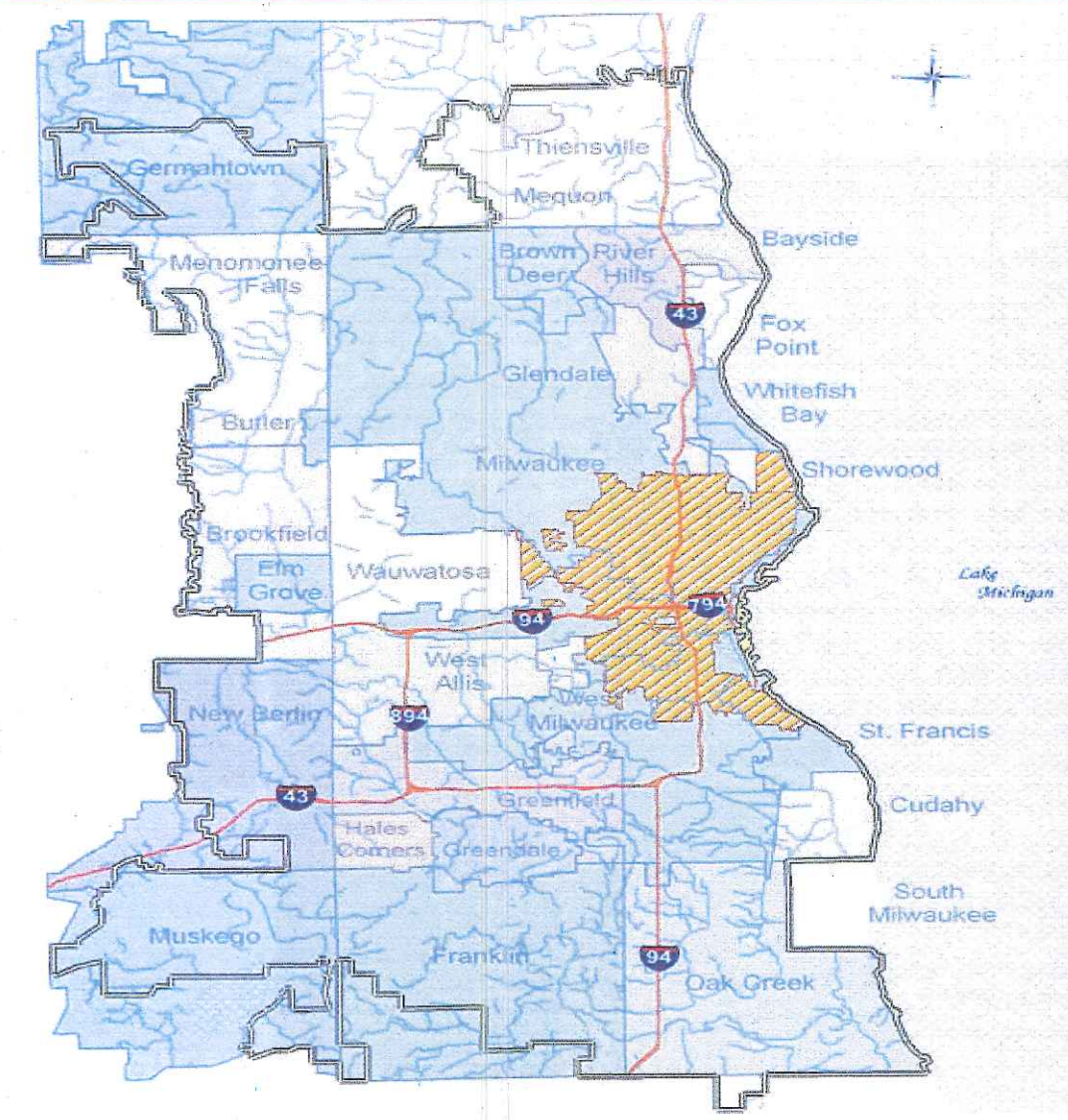
Appendix B: Facility Presentation on the Milorganite® Heat Drying Process

#1

The Milorganite® Heat Drying Process

Milwaukee Metropolitan Sewerage District

MMSD
PARTNERS FOR A CLEANER ENVIRONMENT



MMSD Serves:

- 1.1 Million Customers
- 28 Municipalities
- 411 Square Miles

Water Reclamation Facilities

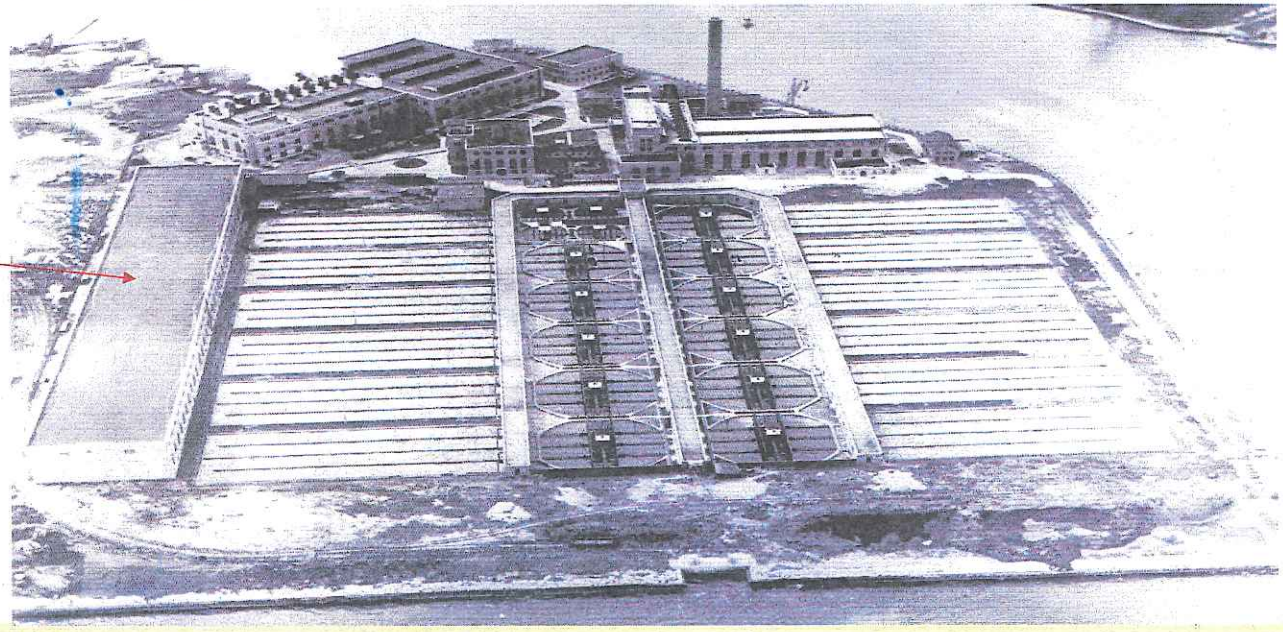
- Jones Island
  - Downtown Milwaukee
  - 330 MGD design capacity
  - 90 MGD typical dry weather flow
  - Where Milorganite® manufacturing occurs
  - Current drying facility in operation since 1994

- South Shore
  - Oak Creek
  - 250 MGD design capacity
  - 90 MGD typical dry weather flow
  - Anaerobic digesters fed primary sludge

- Connected by pipelines for integrated operation

Jones Island

- Completed in 1925
- First municipal activated sludge treatment facility
- National civil engineering landmark



Milorganite®

- Since 1926
- Marketed as a commercial fertilizer
- Markets developed with turf science and professional turf care

First Rail Car 1926

EPA
United States
Environmental Protection
Agency

Biosolids Technology Fact Sheet
Heat Drying

DESCRIPTION

Heat drying, in which heat from direct or indirect dryers is used to evaporate water from wastewater solids, is one of several methods that can be used to reduce the volume and improve the quality of wastewater biosolids. A major advantage of heat drying versus other biosolids improvement methods, however, is that heat drying is ideal for producing Class A biosolids.

Class A biosolids, as defined in 40 CFR Part 503, are biosolids that have met "the highest quality" pathogen reduction requirements confirmed by analytical testing and/or the use of a Process to Further Reduce Pathogens (PFRP) as defined in 40 CFR Part 257. One advantage of Class A biosolids is that they are approved for unrestricted users for many years. They can be directly applied to agricultural fields, lawns, etc. or mixed with other ingredients prior to application.

APPLICABILITY

Heat drying is an effective biosolids management option for many facilities that desire to reduce biosolids volume while also producing an end-product that can be beneficially reused. For example, the Milwaukee Metropolitan Sewage District (MMSD) has been heat-drying wastewater solids and marketing the end-product as a fertilizer since the 1920s (USEPA 1979). The technology has gained popularity since the mid-1980s, as many large urban wastewater solids generators, especially on the east coast, have shifted from ocean disposal to land-based bene-

Method 1680: Fecal Coliforms in Sewage Sludge (2010)

7.11 Milorganite® (CAS 8049-99-8) or equivalent

Milorganite® (heat-dried Class A biosolid) is produced by Milwaukee Metropolitan Sewerage District. It is available in many home gardening centers.

Obtain Milorganite® as the reference matrix for initial precision and recovery (IPR) and ongoing precision and recovery (OPR) analyses. Milorganite® is used as the reference matrix because it is easily accessible, inexpensive, generally does not contain the analyte of interest, and is of consistent quality.

Current Products

- Retail
  - 36 pound bag
  - 5 pound bag
- Professional
  - 50 pound bag
  - 50 pound bag greens grade
  - 1,000 pound bag
- Blending
  - Truck
  - Railcar

Life in the Fertilizer Marketplace

- Biosolids regulations
- Fertilizer regulations
- Customer satisfaction

Product Consistency

- Compliance with Regulations
- Performance
  - Nutrients
  - Precise sizing to match fertilizer spreaders
- Over time
- Throughout the country

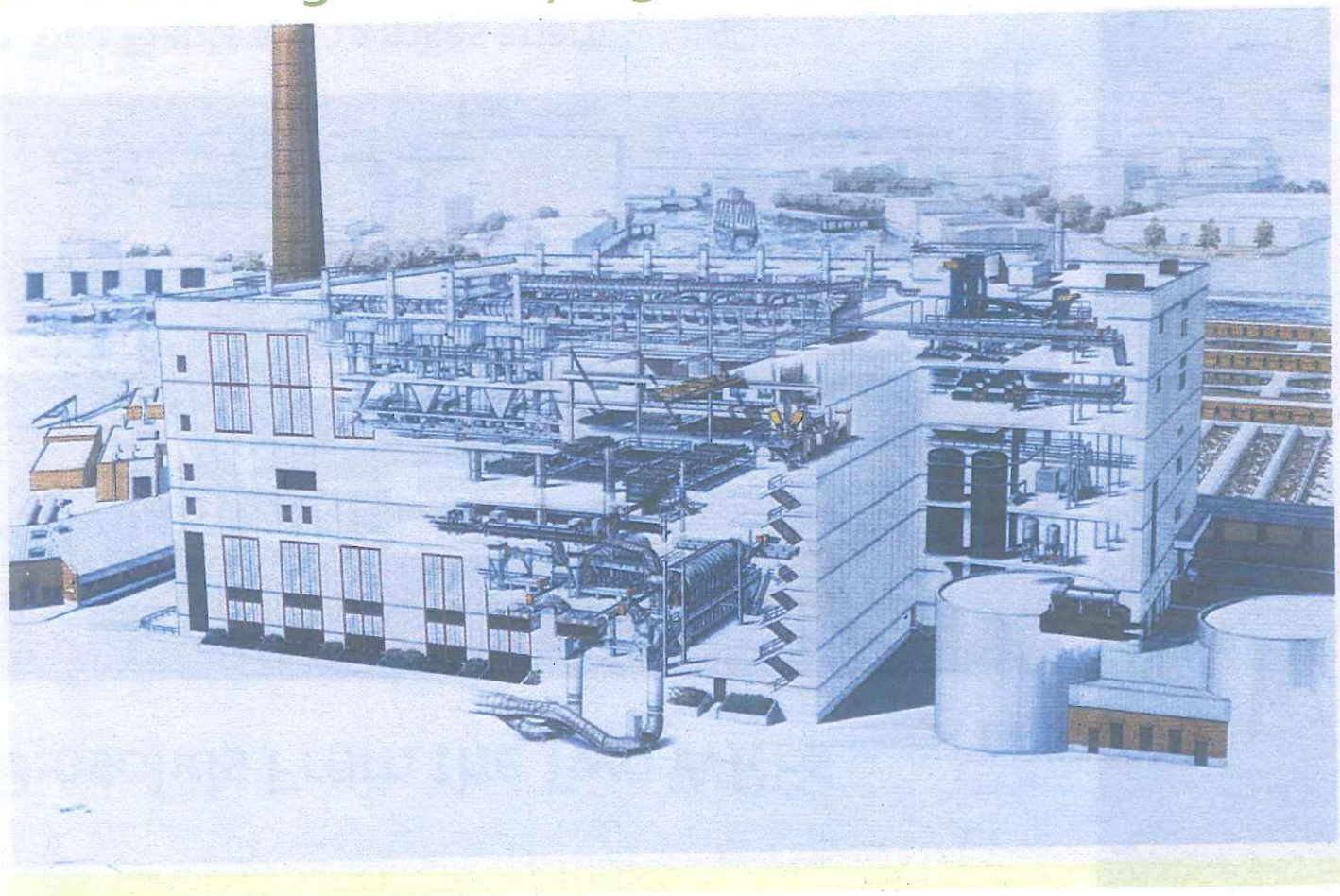
How do we achieve consistency with variable inputs?

Massive amounts of recycling!

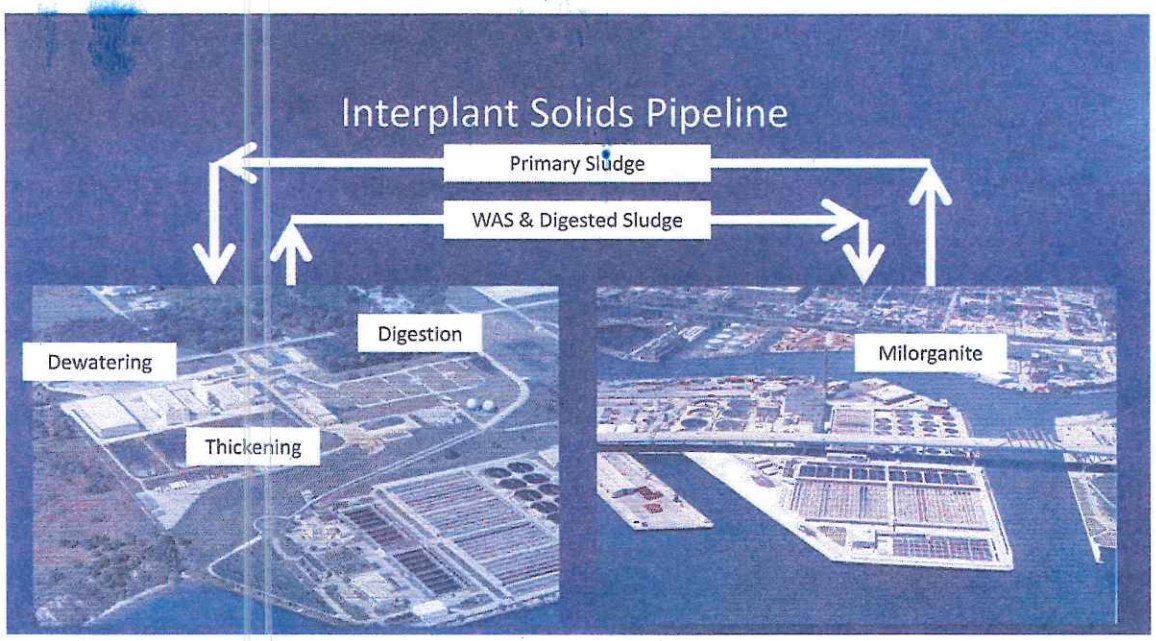
Recycling Systems

- Continuous
  - Dryer to dryer
  - Central recycling bins
  - Sizing to recycling bins
- Intermittent
  - Dryer discharge screw failure
  - Single dryer

Dewatering and Drying Facility



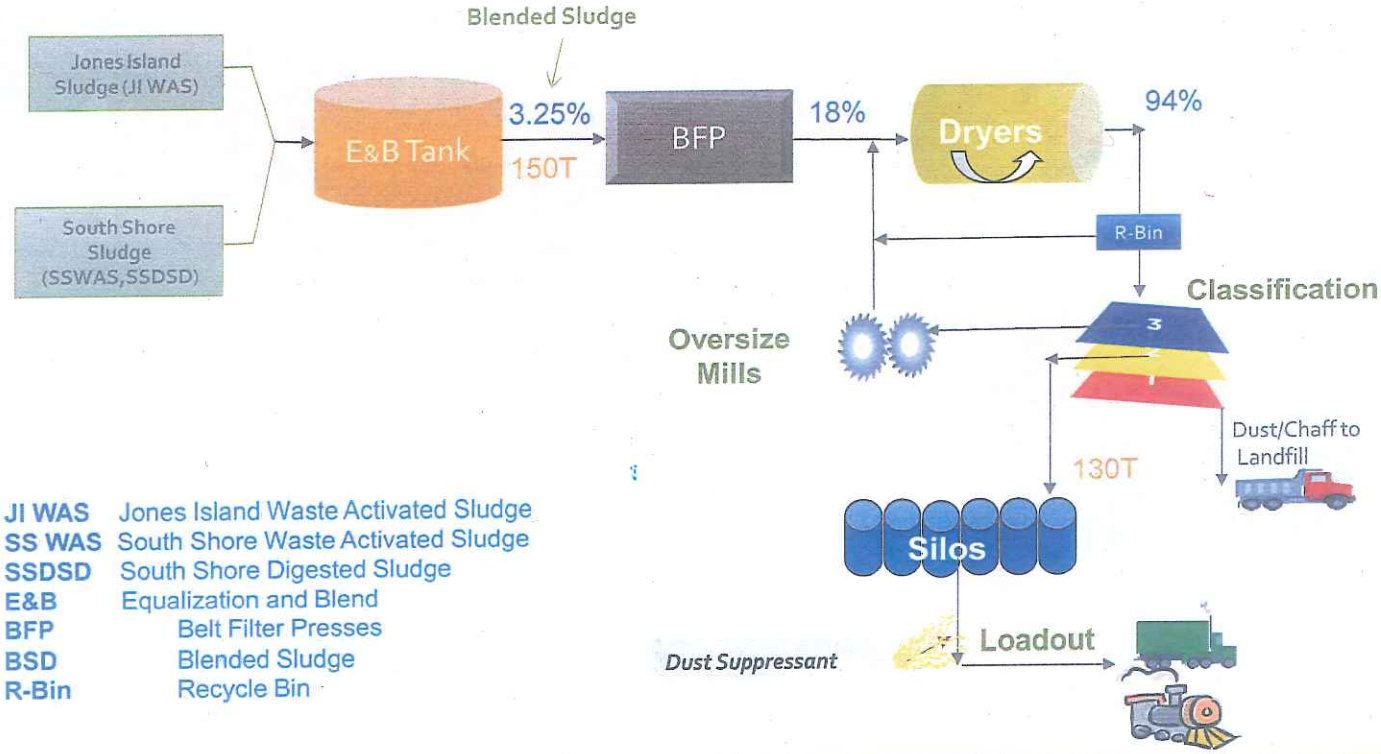
Biosolids From the Two WRFs



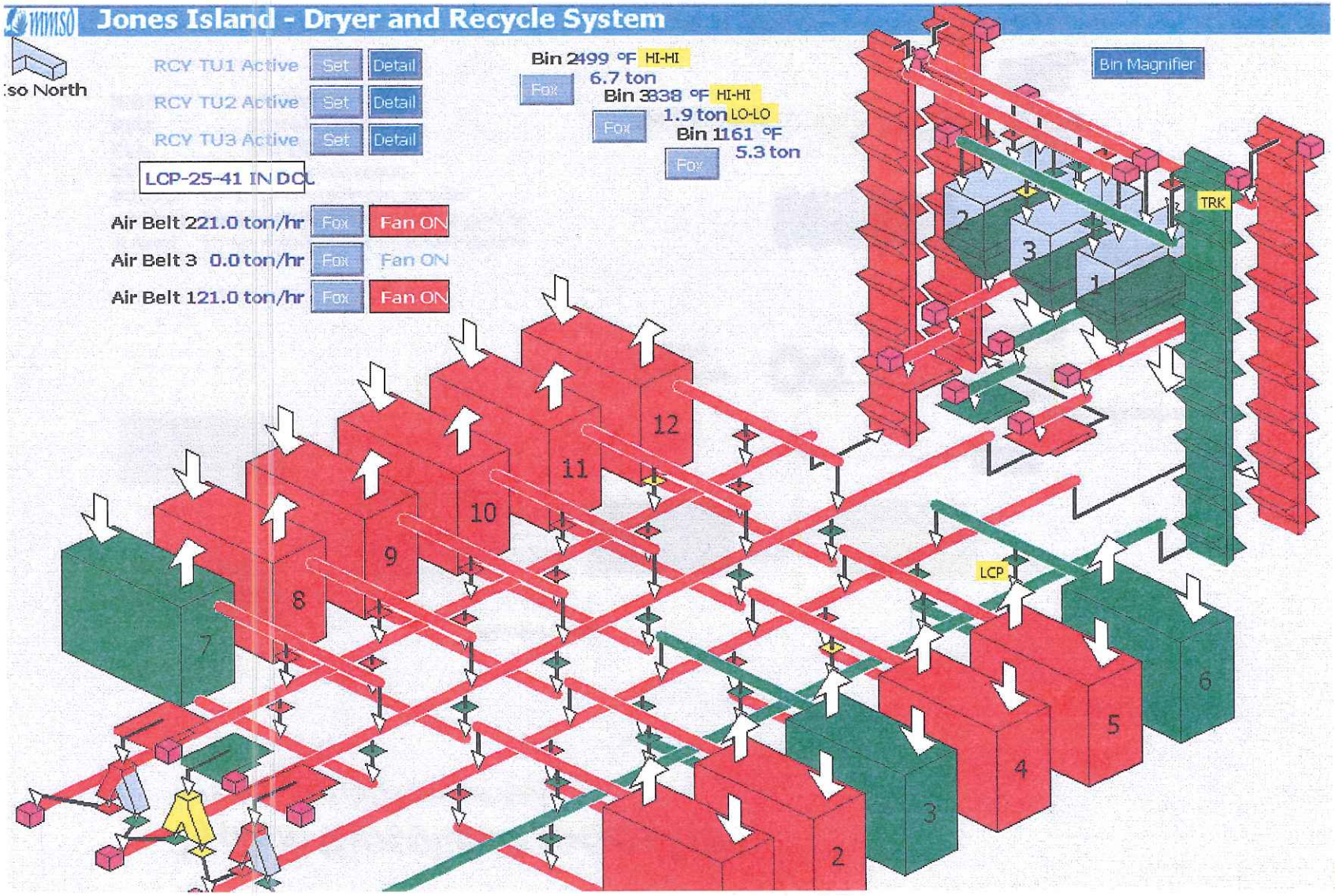
- Two Plants are 12 miles apart
- **4 ISP lines: 2-14" and 2-12"**
- **Ductile iron** force mains

Typical Biosolids Process Day

%TS and Mass (Dry tons per day)



JI WAS	Jones Island Waste Activated Sludge
SS WAS	South Shore Waste Activated Sludge
SSDSD	South Shore Digested Sludge
E&B	Equalization and Blend
BFP	Belt Filter Presses
BSD	Blended Sludge
R-Bin	Recycle Bin


Jones Island - Dryer and Recycle System
so North
RCY TU1 Active
Set
Detail
RCY TU2 Active
Set
Detail
RCY TU3 Active
Set
Detail
LCP-25-41 IN DCL
Air Belt 221.0 ton/hr
Fox
Fan ON
Air Belt 3 0.0 ton/hr
Fox
Fan ON
Air Belt 121.0 ton/hr
Fox
Fan ON
Bin 2499 °F HI-HI
Fox
6.7 ton
Bin 3838 °F HI-HI
Fox
1.9 ton LO-LO
Bin 1161 °F
Fox
5.3 ton
Bin Magnifier
TRK
LCP
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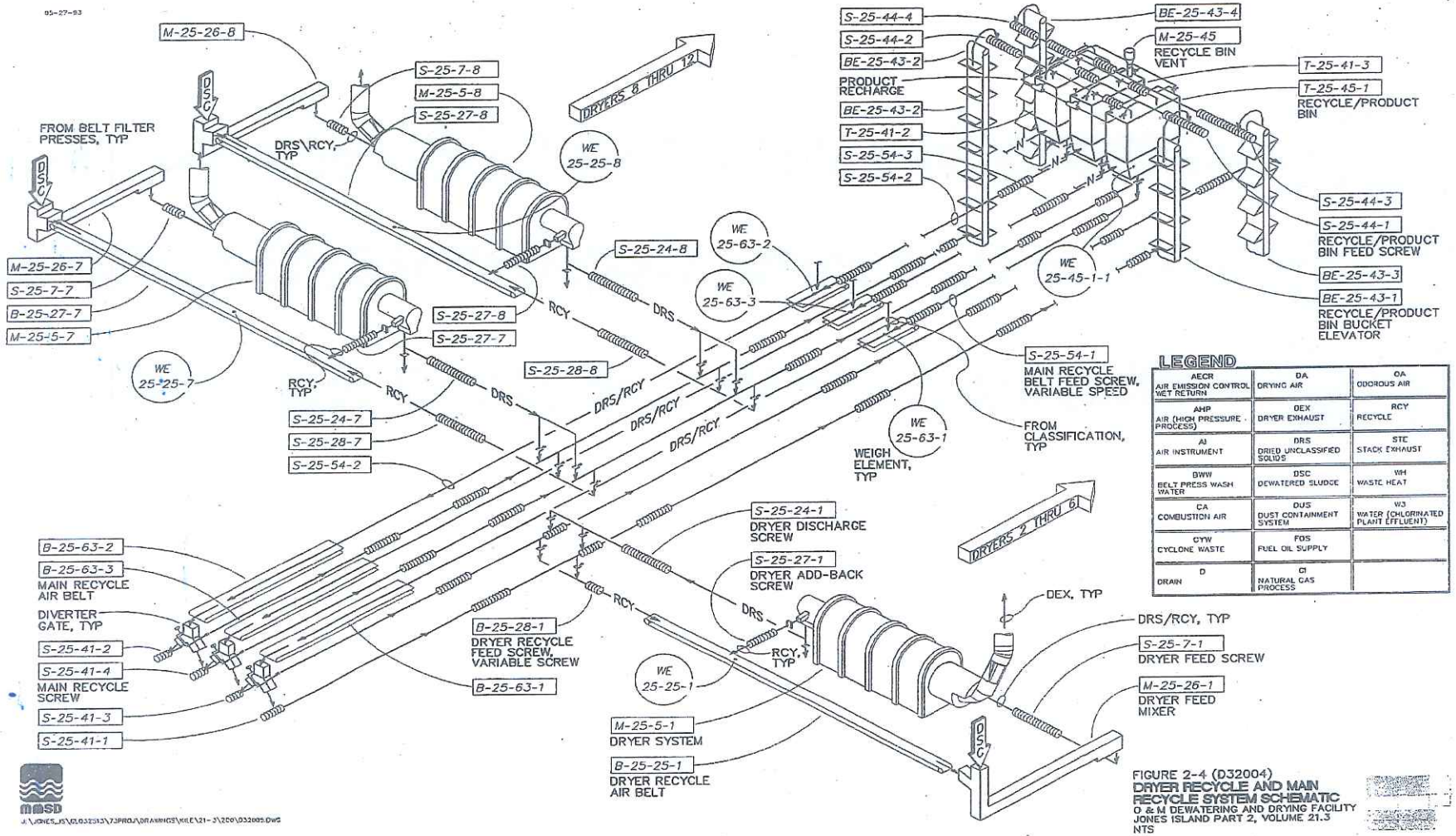
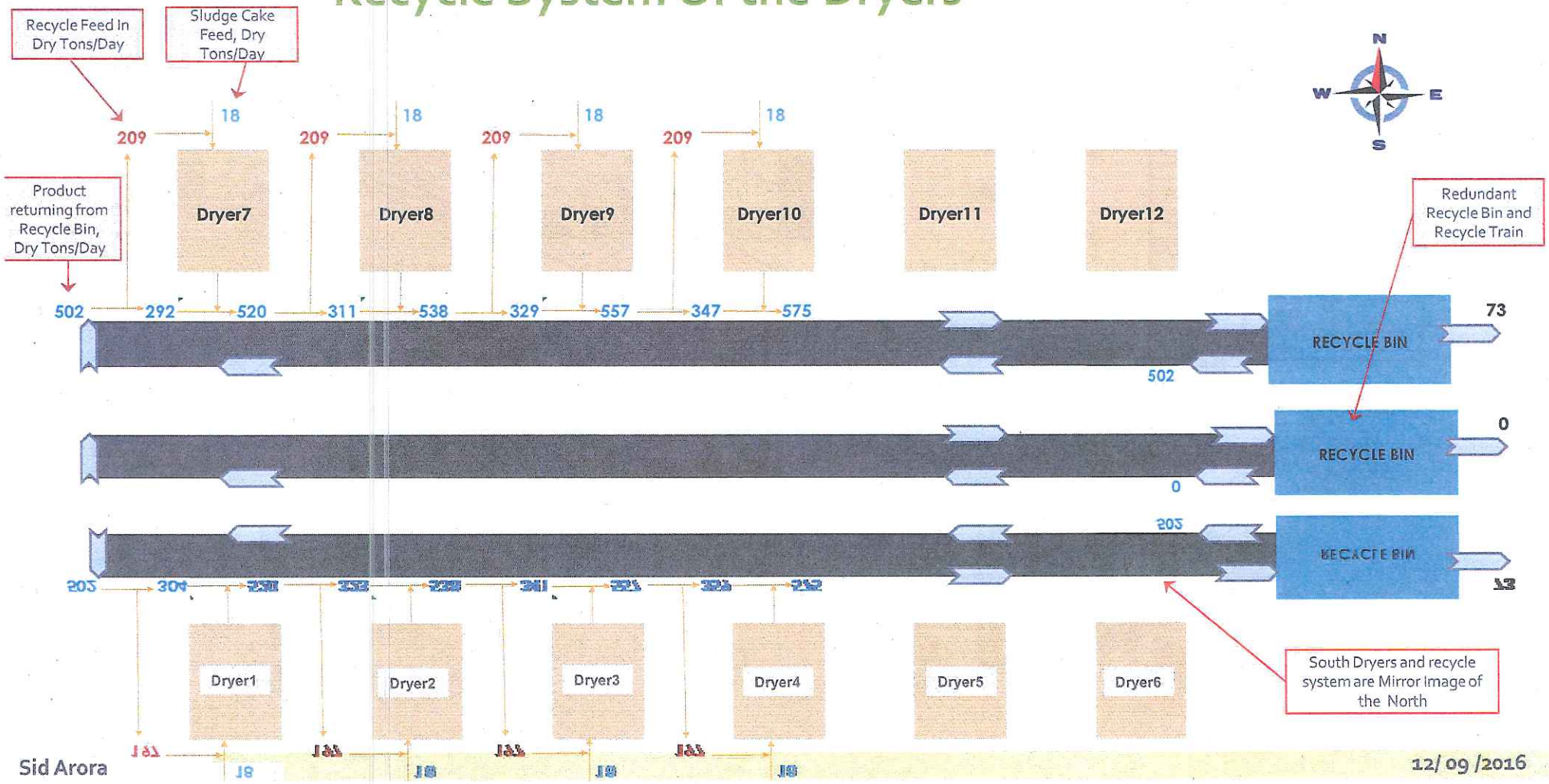


FIGURE 2-4 (D32004)
DRYER RECYCLE AND MAIN RECYCLE SYSTEM SCHEMATIC
O & M DEWATERING AND DRYING FACILITY
JONES ISLAND PART 2, VOLUME 21.3
NTS

Recycle System Of the Dryers



Sid Arora

12/ 09 /2016

Dryer Furnace and Product Temperatures

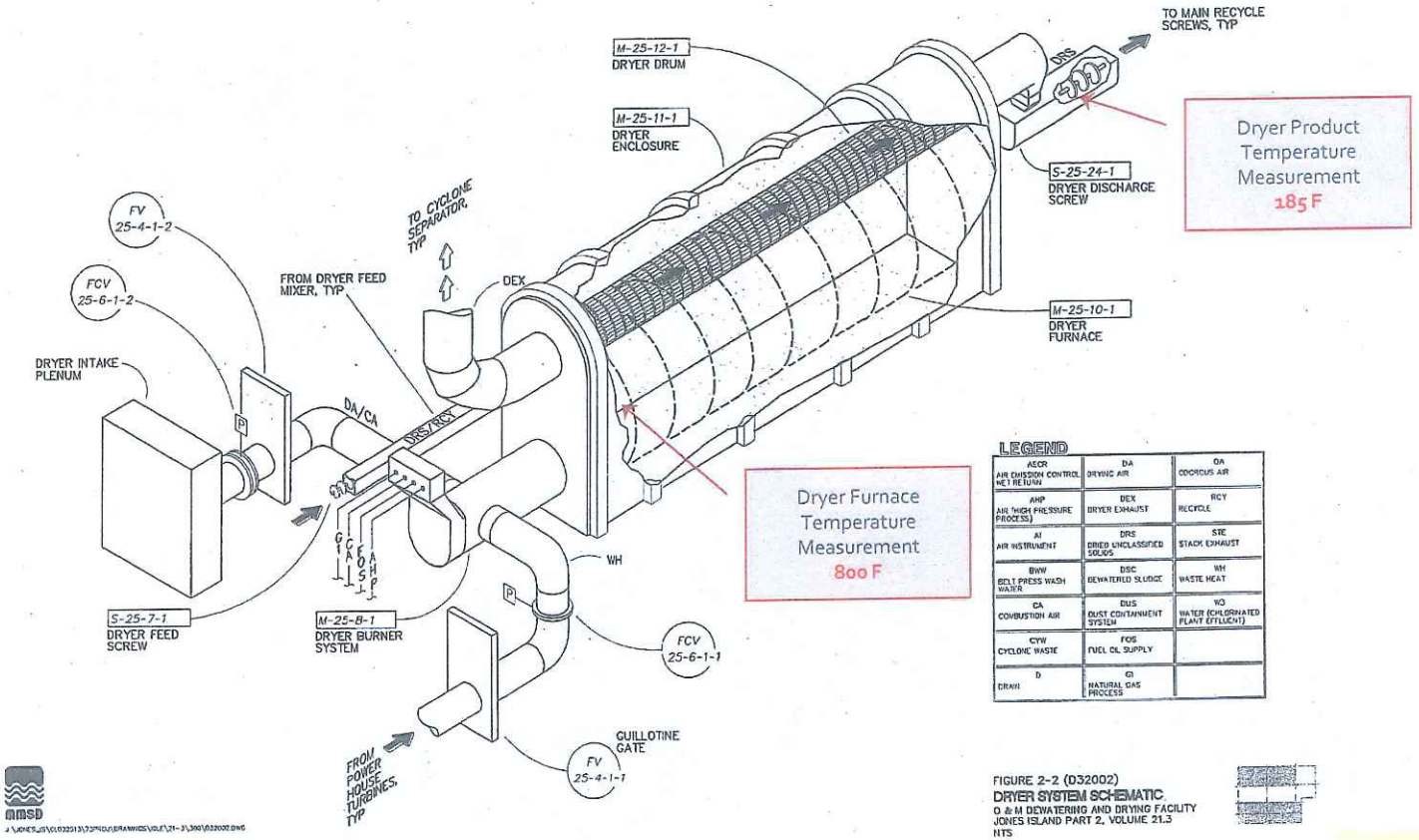
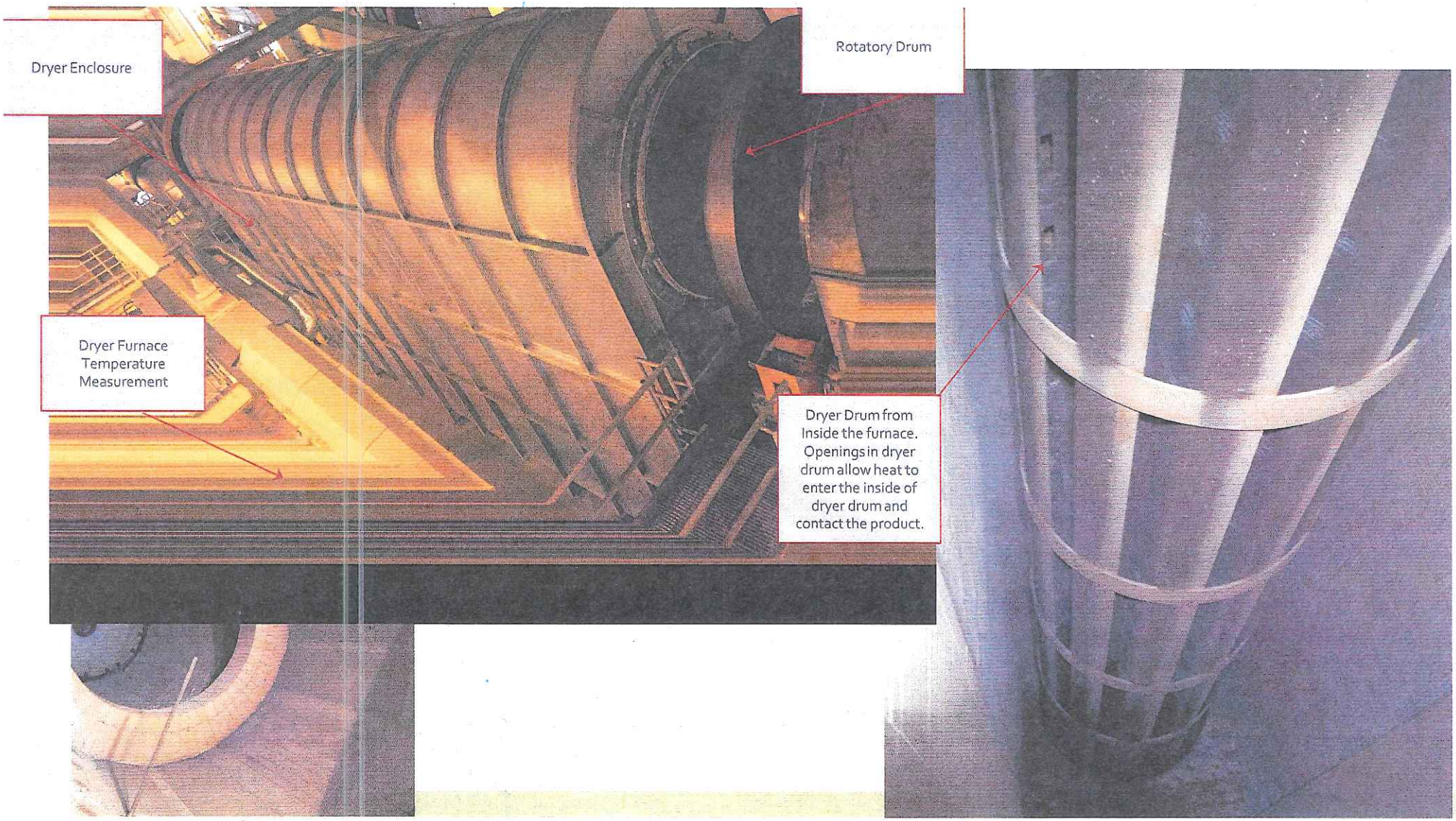


FIGURE 2-2 (D32002)
DRYER SYSTEM SCHEMATIC
O & M DEWATERING AND DRYING FACILITY
JONES ISLAND PART 2, VOLUME 21.3
NTS


Dryer Enclosure
Rotatory Drum
Dryer Furnace Temperature Measurement
Dryer Drum from Inside the furnace. Openings in dryer drum allow heat to enter the inside of dryer drum and contact the product.

Blue=Dryer Exhaust

Green = Product moving through Dryer Drum.

Red =Heat to the dryer by Turbine WH or NG Burner.

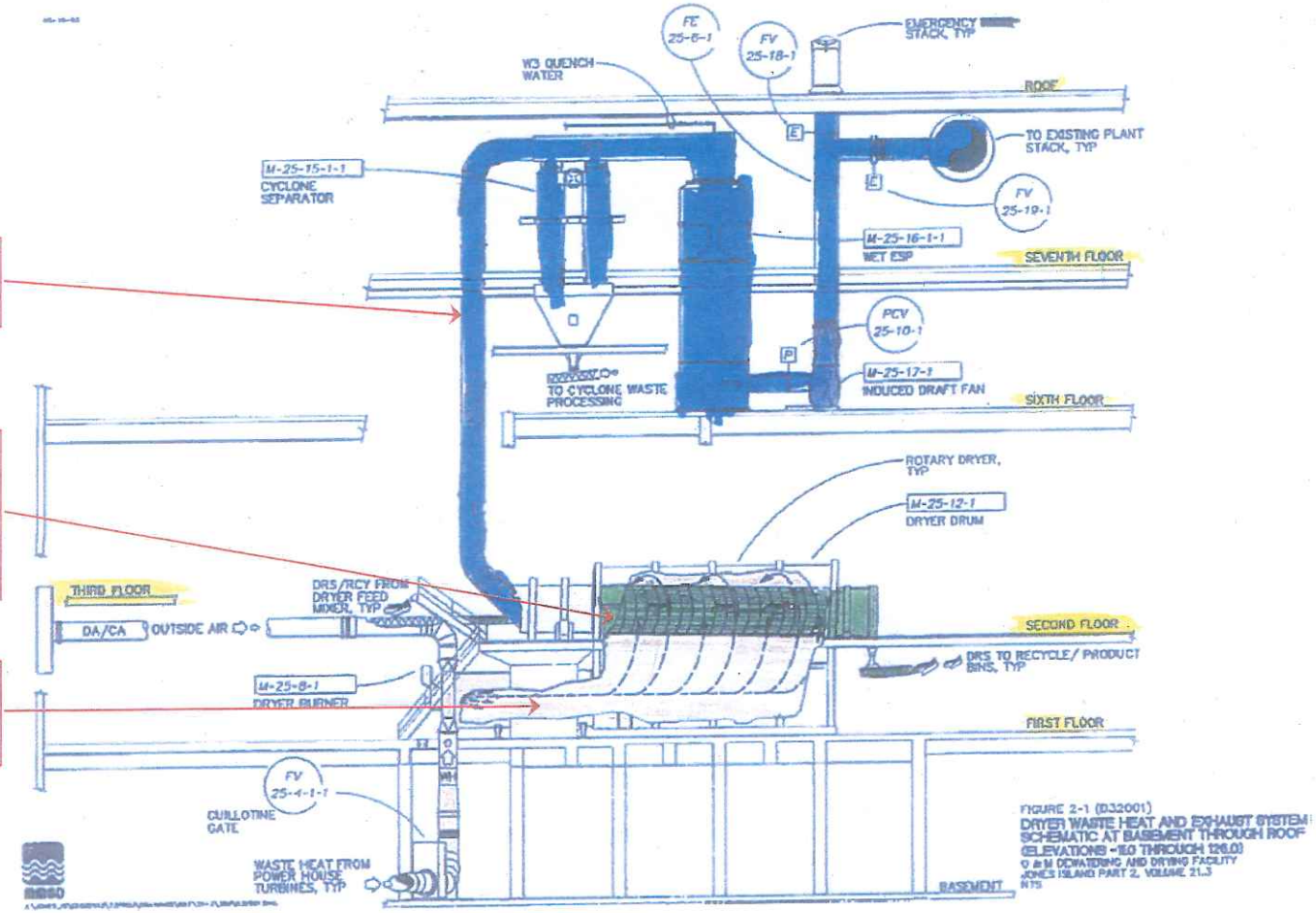
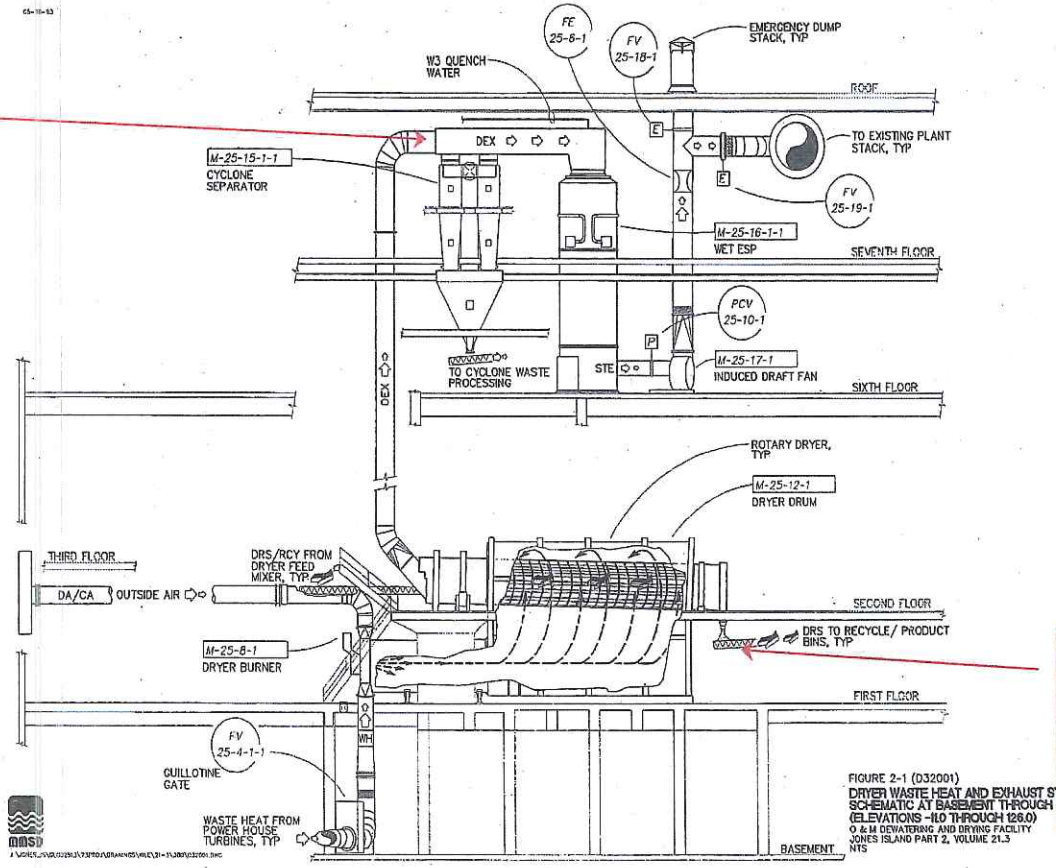


FIGURE 2-1 (D32001)
DRYER WASTE HEAT AND EXHAUST SYSTEM SCHEMATIC AT BASEMENT THROUGH ROOF ELEVATIONS -11.0 THROUGH 126.0
O & M DEWATERING AND DRYING FACILITY
JONES ISLAND PART 2, VOLUME 21.3
NTS

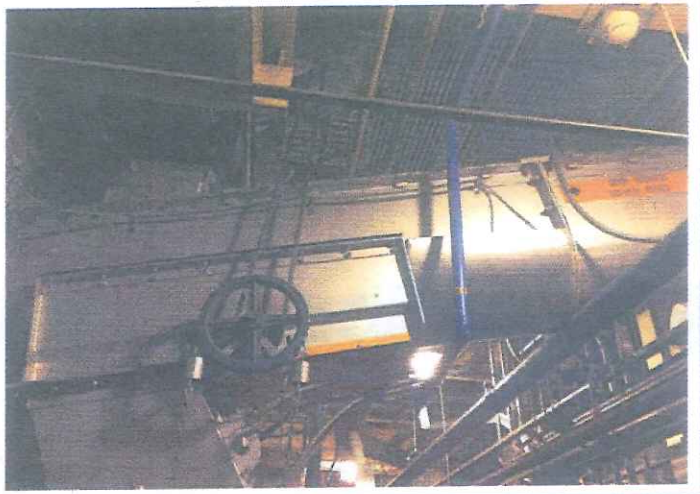
Dryers Exhaust Temperature Measurement

Dryer Exhaust Gas Temperature Measurement on 7th floor.
180 F (typical)



Dryer Product Temperature Measurement. 19 ft from the actual discharge of the product.
185 F (typical SP)

Dryer Product Temperature Measurement



Probability Analysis of Dryer Product Temp Greater than 176F

Draft

Annual Average for Calander Year 2015	Wet Tons/Day	% TS	Dry Tons/day
BFP Sludge Cake Processed in Dryers in 2015 (annual Ave)	826	17.7%	146.5
Base Recycle Dry Product in 2015(annual Ave)	538	93.2%	502

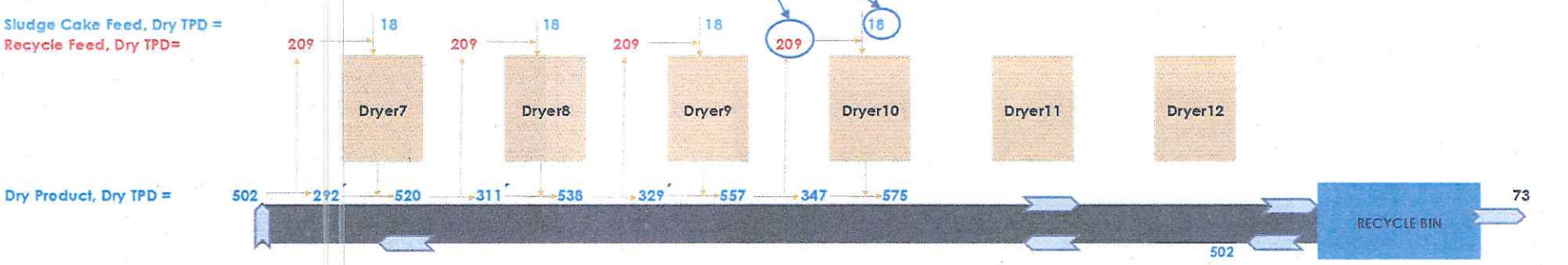
Dryer Feed (Wet Vs Dry) based on Recycle Ratio	Wet Tons/Day	% TS	Dry Tons/day
Sludge Cake Feed per Dryer /Day	103	17.7%	18
Recycle Feed per Dryer /Day	224	93.2%	209

% Dryed Recycle in Dryer Feed (2015 Annual Ave) 68.5%

Wet Tons of Recycle Product / (Wet tons of Sludge Cake +Wet Tons of Recycle Product)

Average Number of Dryers in Service 8 (4 Dryers on each Side)

North Side Dryers Mass Balance (Based on a Annual Average Dry Tons/Day)



Dry Product going through Single pass from:					Dry Product going through Single pass, Dry Tons/day
Dryer 1	18	11	7	4	0.6
Dryer 2		18	11	7	1.0
Dryer 3			18	11	1.7
Dryer 4				18	2.7
Dryer 5	Out of Service				0.0
Dryer 6	Out of Service				
	18	29	36	41	6
					1.0%

Total Product in circulation, TPD	575
Product going through single pass from a Dryer, TPD	6
% Particles Temperature Measured in 2015 that are <176 F	8%
Probalility of Dryer Product <176 F	0.08%

Probability of Dryer product leaving the system with Temp >176F = 99.9%

Sid Arora

12/ 09 /2016

Actual Data for the year 2015 used

Annual Average for Calander Year 2015	Wet Tons/Day	%TS	Dry Tons/day
BFP Sludge Cake Processed in Dryers in 2015 (annual Ave)	826	17.7%	146.5
Base Recycle Dry Product in 2015(annual Ave)	538	93.2%	502

Dryer Feed (Wet Vs Dry) based on Recycle Ratio	Wet Tons/Day	%TS	Dry Tons/day
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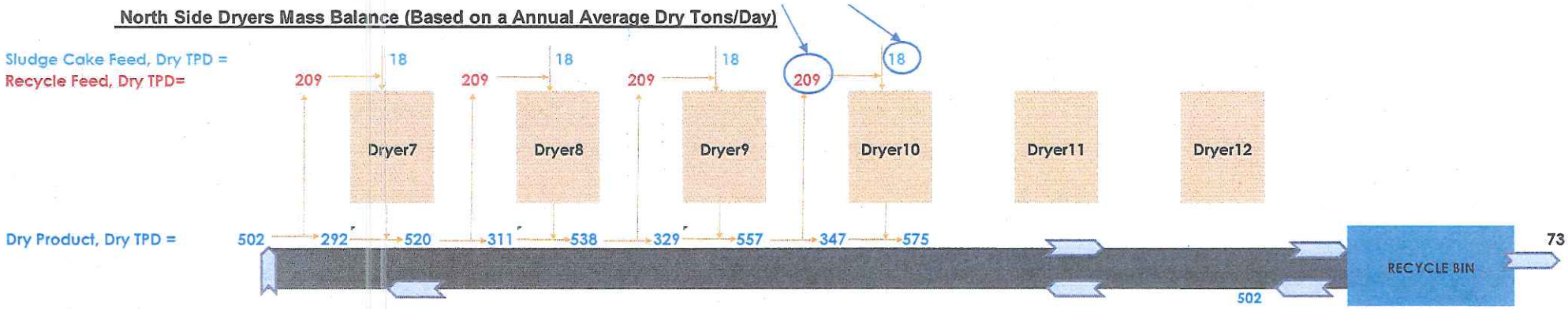
Recycle Feed per Dryer /Day	224	93.2%	209

% Dryed **Recycle** in Dryer Feed (2015 Annual Ave) **68.5%**

Wet Tons of Recycle Product / (Wet tons of Sludge Cake +Wet Tons of Recycle Product)

Average Number of Dryers in Service **8** (4 Dryers on e

North Side Dryers Mass Balance (Based on a Annual Average Dry Tons/Day)



Dry Product going through Single pass from:

					Dry Product going through Single pass, Dry Tons/day
Dryer 1	18	11	7	4	0.6
Dryer 2		18	11	7	1.0
Dryer 3			18	11	1.7
Dryer 4				18	2.7
Dryer 5	Out of Service				0.0
Dryer 6	Out of Service				
	18	29	36	41	6
					1.0%

Total Product in circulation, TPD	575
Product going through single pass from a Dryer, TPD	6
% Particles Temperature Measured in 2015 that are <176 F	8%
Probalility of Dryer Product <176 F	0.08%

Probability of Dryer product leaving the system with Temp >176F = **99.9%**

12/ 09 /2016

40 CFR Part 503 Biosolids Rule

- Heat Drying - Sewage sludge is dried by direct or indirect contact with hot gases to reduce the moisture content of the sewage sludge to 10 percent or lower. Either the **temperature of the sewage sludge particles** exceeds 80 degrees Celsius or the wet bulb temperature of the **gas in contact with the sewage sludge as the sewage sludge leaves the dryer** exceeds 80 degrees Celsius.

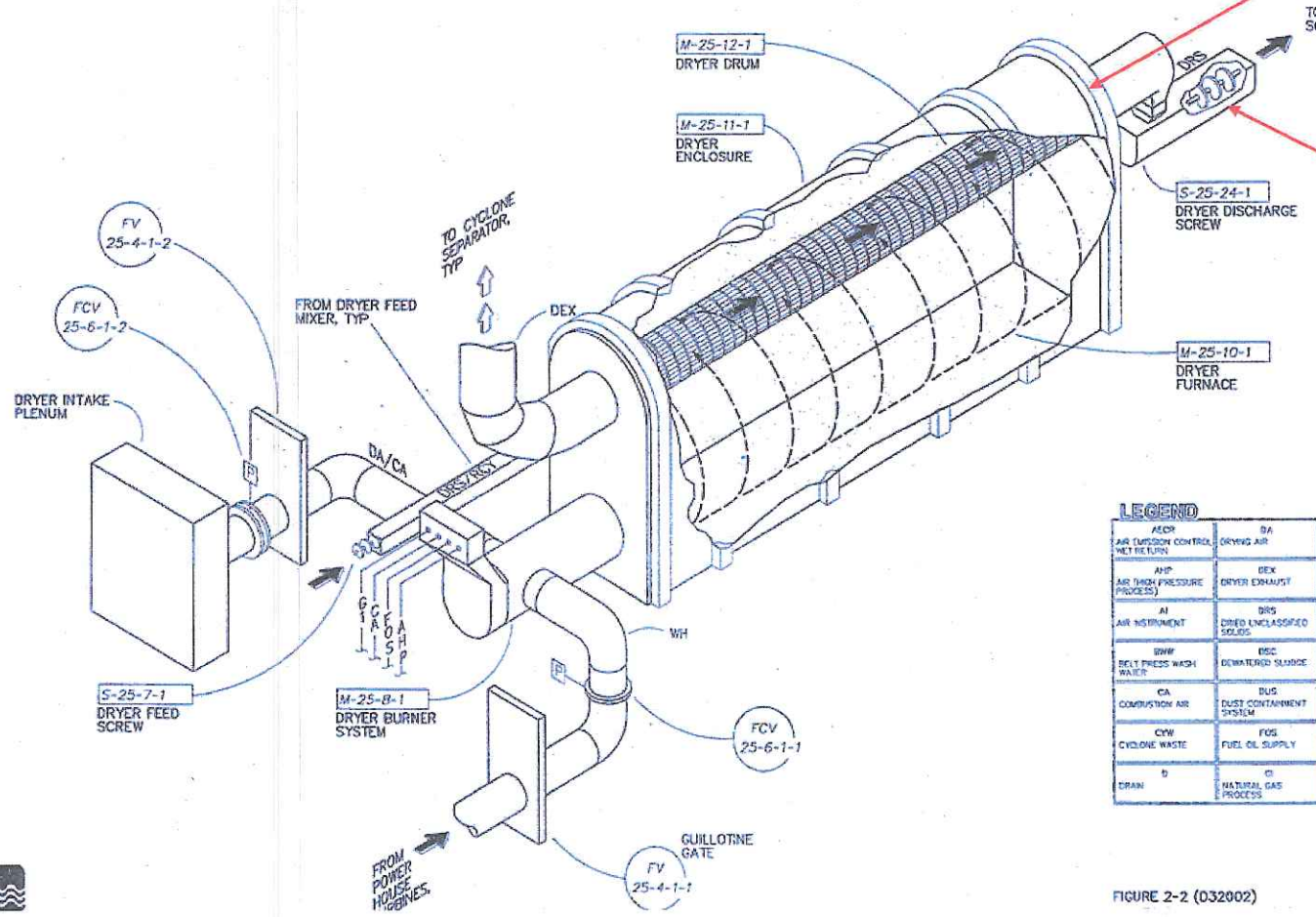
Air Temperature Monitoring

A

Air Temperature Measurement s

C

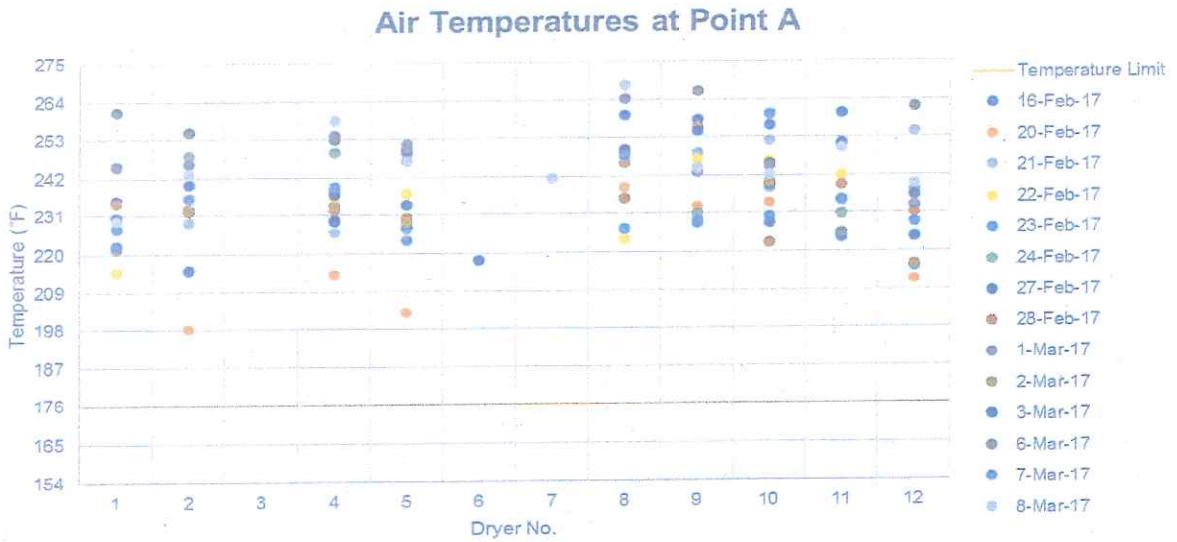
Current **Product** Temperature Measurement

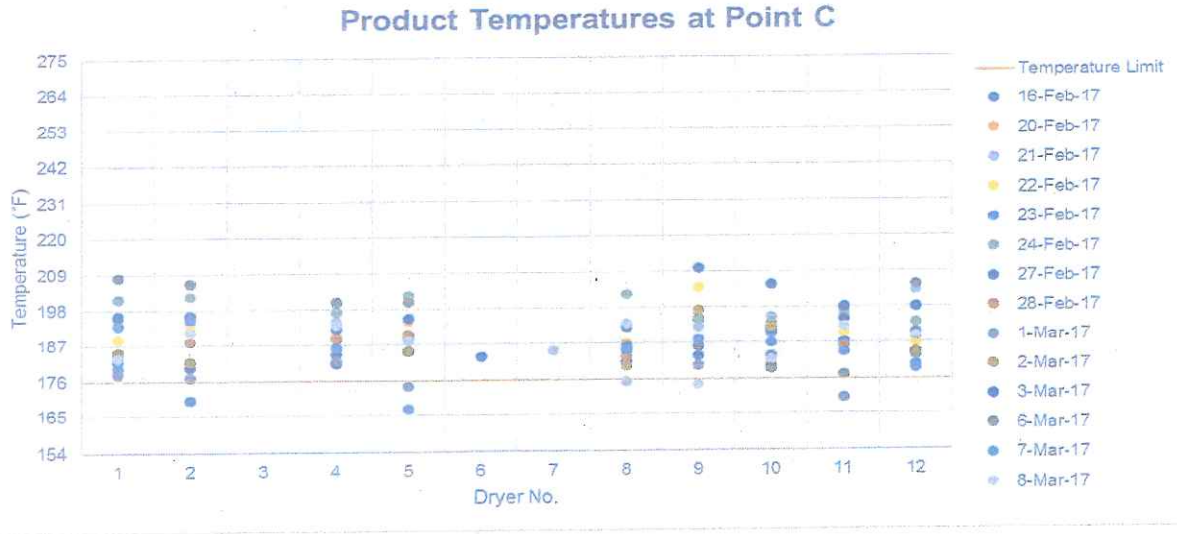


LEGEND

AECR AIR EMISSION CONTROL WET RETURN	DA DRYING AIR	OA COOPOUS AIR
AHP AIR THIGH PRESSURE PROCESS)	DEX DRYER EXHAUST	RCY RECYCLE
AI AIR INSTRUMENT	DRS DRIED UNCLASSIFIED SOLIDS	STE STACK EXHAUST
BWW BELT PRESS WASH WATER	DSC DEWATERED SLUDGE	WH WASTE HEAT
CA COMBUSTION AIR	DUS DUST CONTAINMENT SYSTEM	W3 WATER (CHLORINATED PLANT EFFLUENT)
CYW CYCLONE WASTE	FOS FUEL OIL SUPPLY	
D DRAIN	GI NATURAL GAS PROCESS	

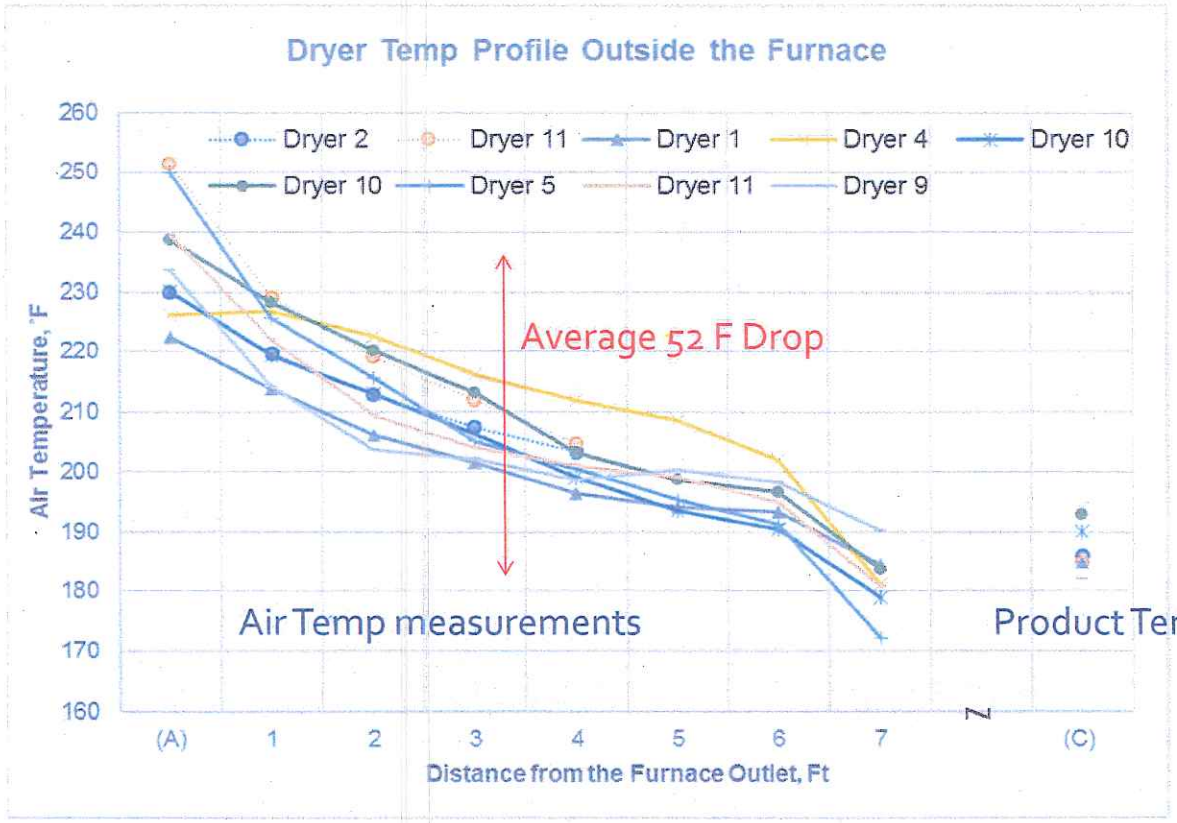
FIGURE 2-2 (032002)





Air Temperature Monitoring Data

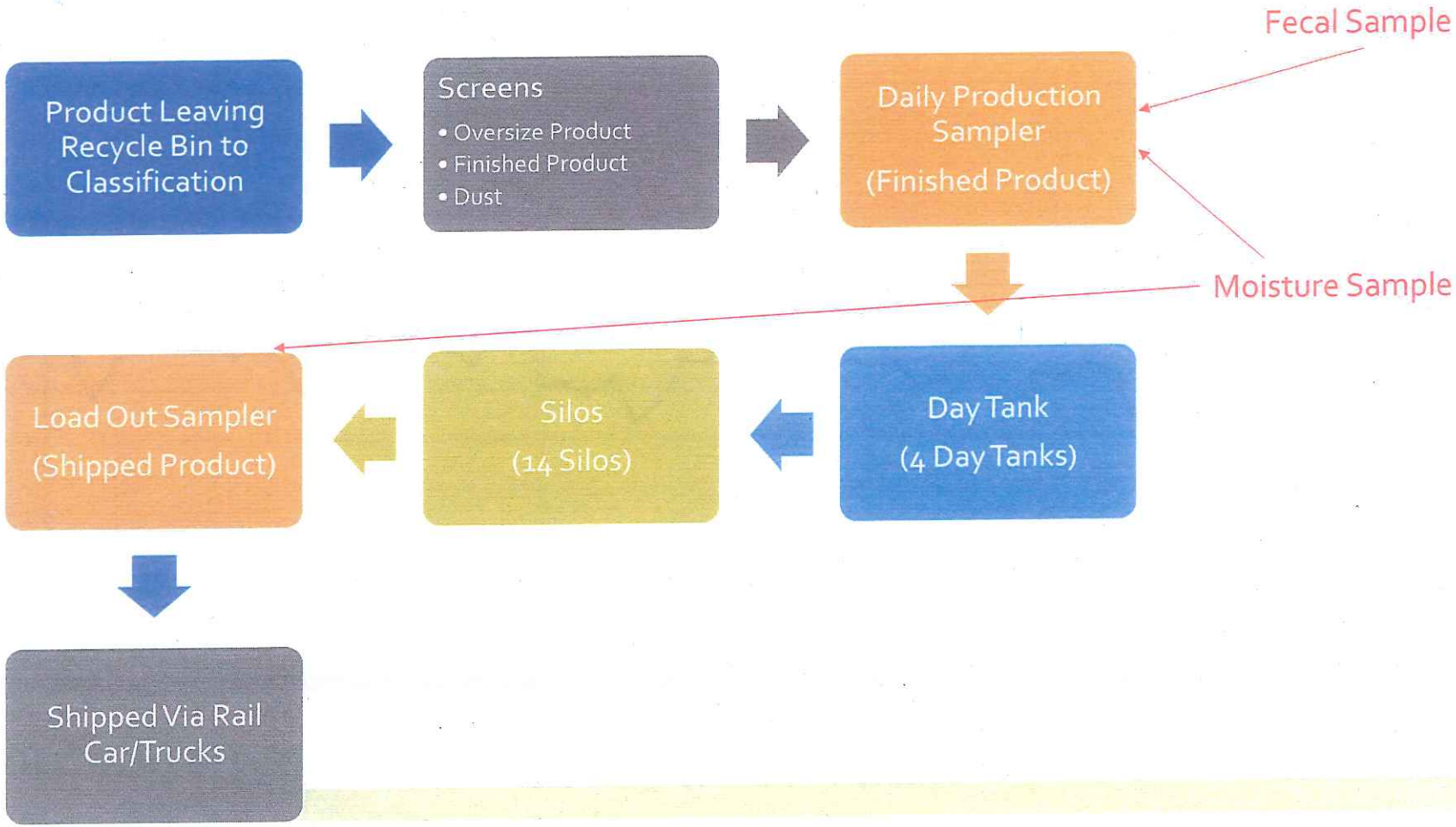
- Manual Air Temperature Monitoring started on February 16, 2017
- Purpose was to support the demonstration of compliance with heat drying standard.
- Location A = air temperature where product leaves the dryer furnace
- Location C= product temperature readings from the discharge screw approx. 19 ft from furnace discharge



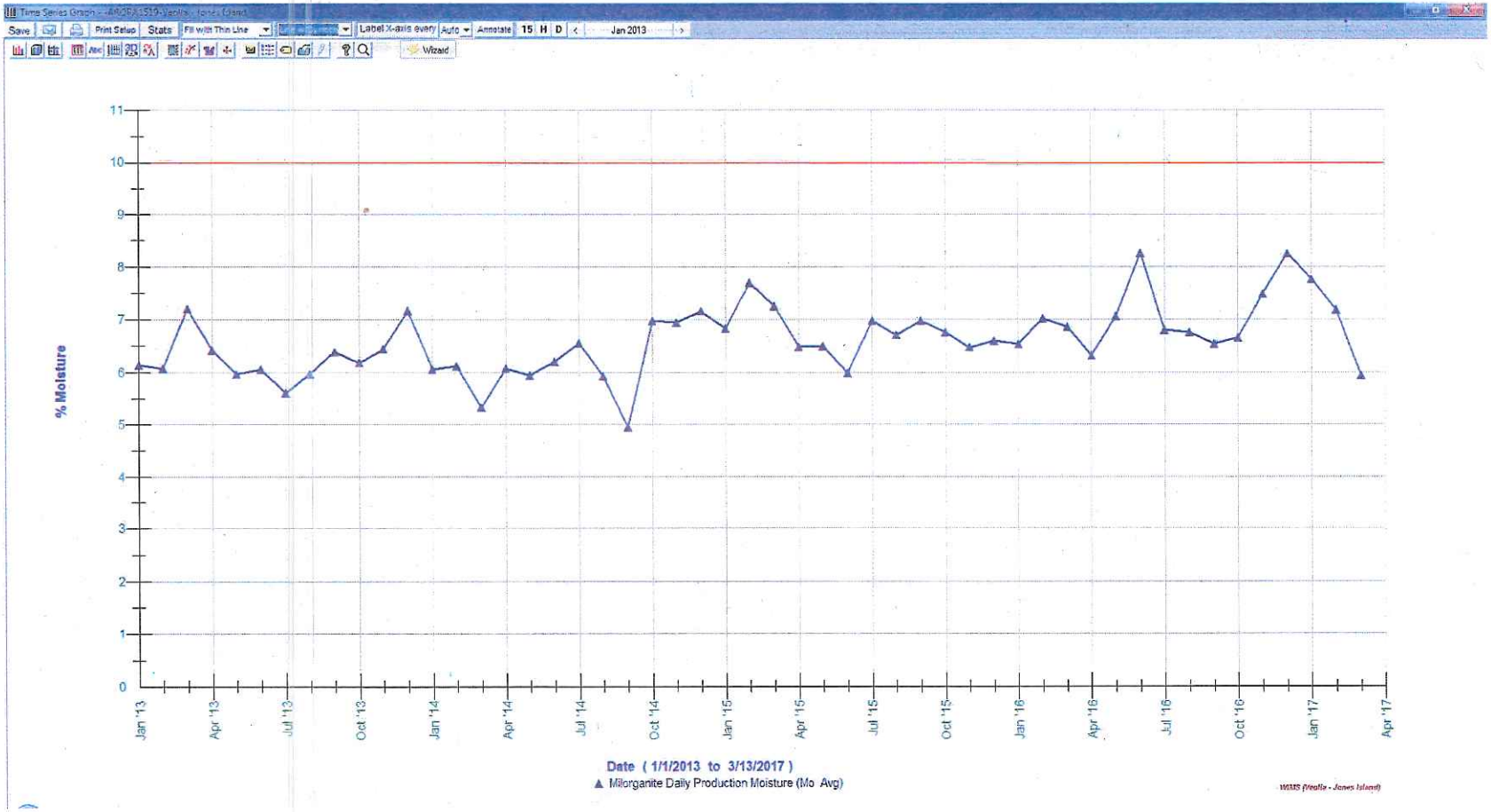
Cooling starts immediately Downstream of the Dryer Furnace

Distance between A &C ≈19ft

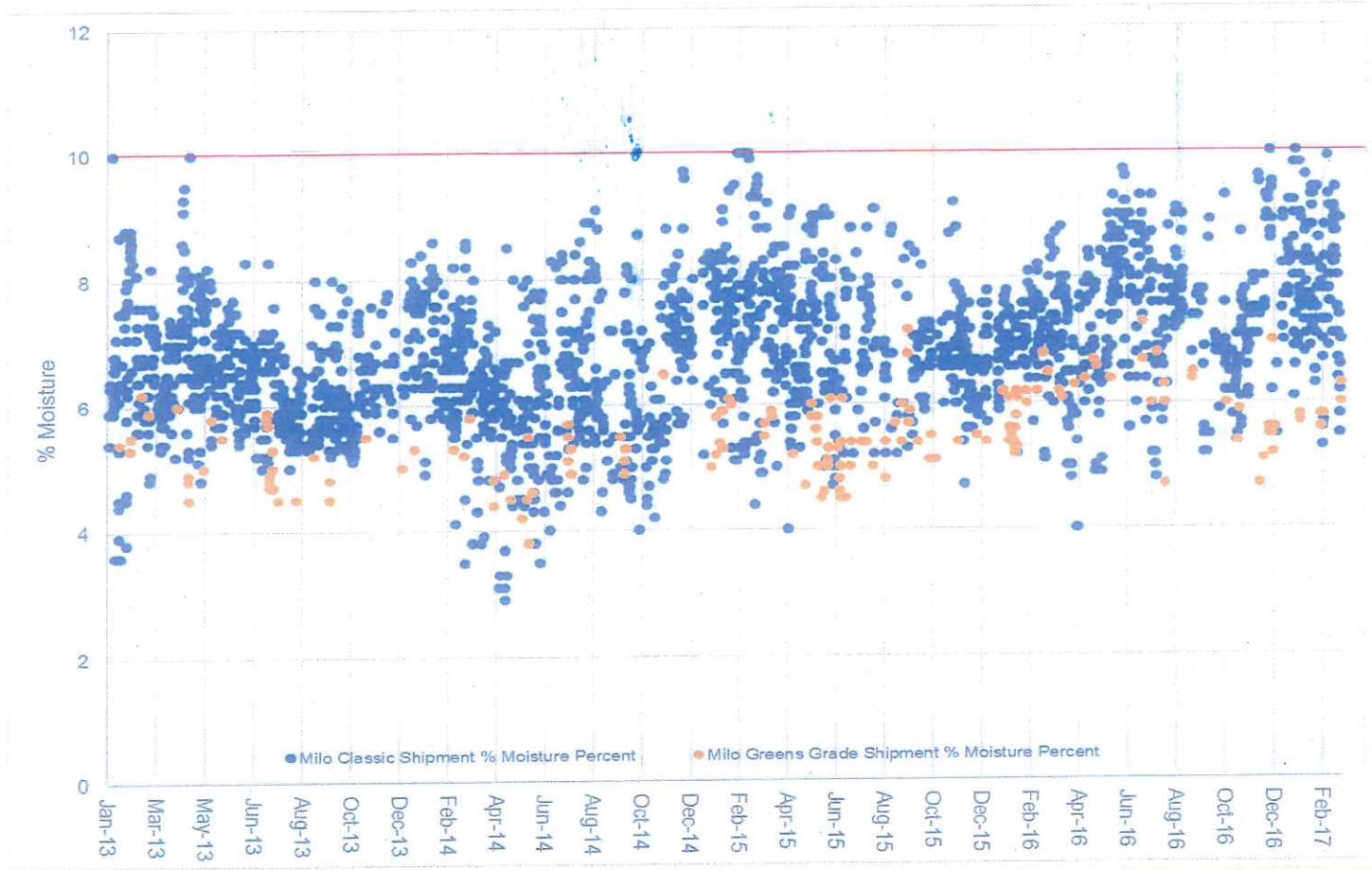
Milorganite Process Control Sampling Locations



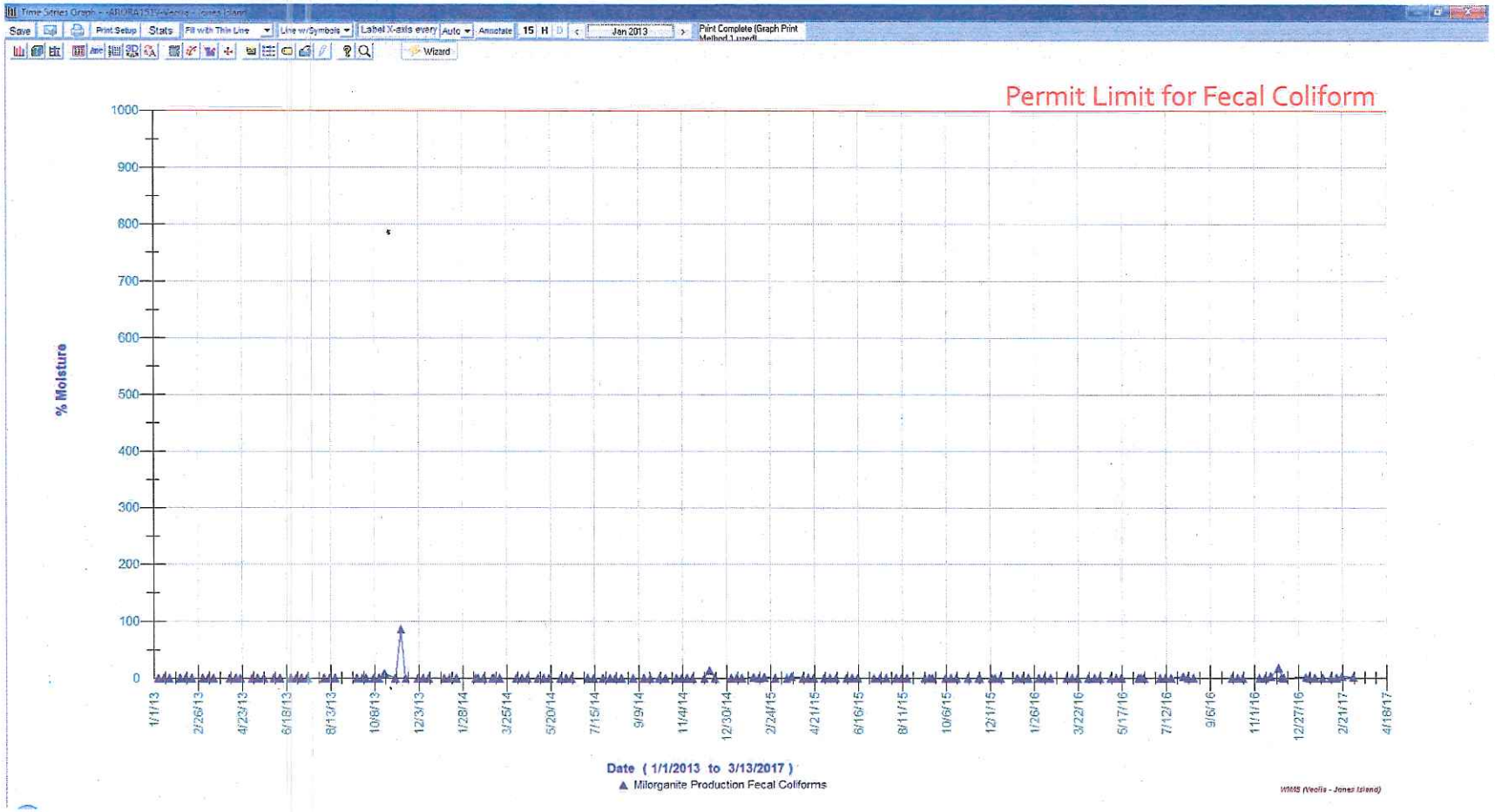
Milorganite Moisture Data (Daily Production) 2013-present



Milorganite Moisture Data (Load Out) 2013-Present



Milorganite Fecal Coliform Data (Daily Production) 2013-present



Milorganite Fecal Coliform Data (Load Out) Feb 2017

Sample Date	LIMS Number	Fecal Coliforms	Limit of Detection
2/22/2017	17004124	8.67	0.2
2/24/2017	17004234	< 0.20	0.2
3/2/2017	17004632	<0.19	0.19
3/2/2017	17004633	1.38	0.19

Results are expressed as most probable number per gram of total solids, MPN/gTS.

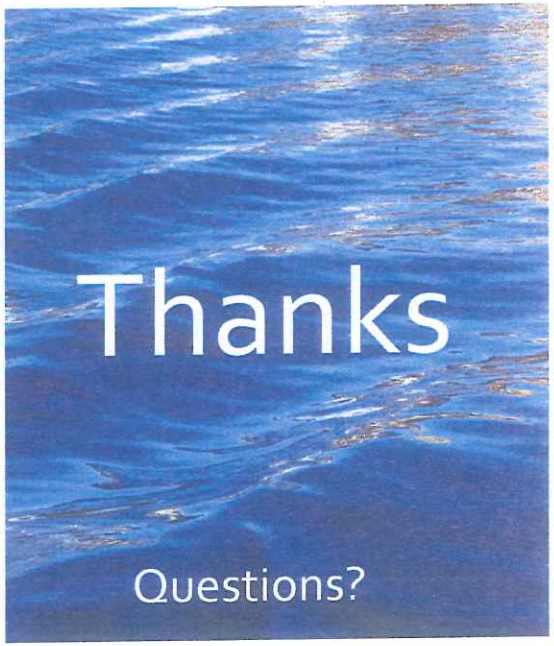
Q&As

- Why does data show some product temps less than 176 F?
  - We are measuring ≈**19 ft**. away from Dryer Furnace outlet, product starts cooling down as soon as product leaves the Dryer Furnace area.
  - Dryer could be operating in Add Back Mode
  - Dryer Discharge Screw has layer of product sticking on the bottom, thereby shielding the real temperatures
  - Dryer Temperature Probe not reading correctly

- Why have we not used existing dryer exhaust temps to show compliance?
  - Air Temps are currently measured 60-80 ft away from the dryer on 7th Floor.

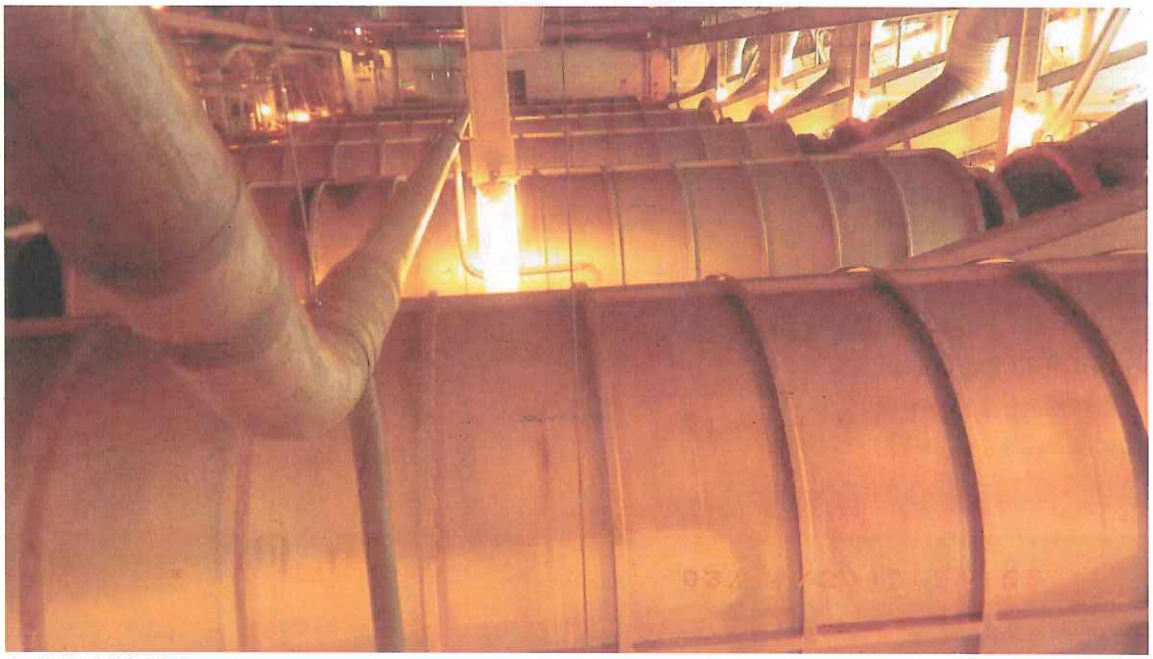
- What do we do if Dryer Product Temperature Measurements show less than 176 F
  - Operator would measure Temperatures manually using a infrared gun and make changes to the dryer operation based on infrared gun temperature measurements.


Milorganite
NATURALLY


Thanks
Questions?

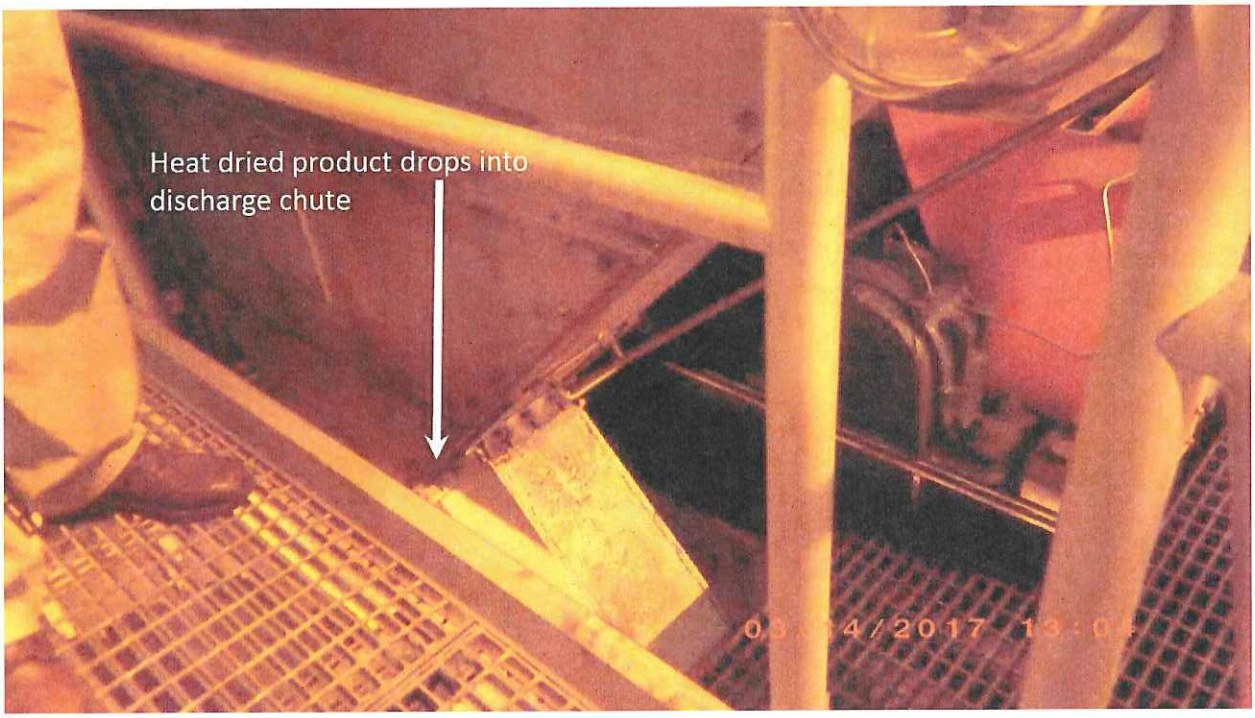
Appendix C: Photo Log

MMSD Milorganite®
EPA Inspection March 14, 2017
All photos taken by Dean Maraldo, Inspector, U.S. EPA
All times in Central Time Zone
Camera: RICOH WG-4 GPS

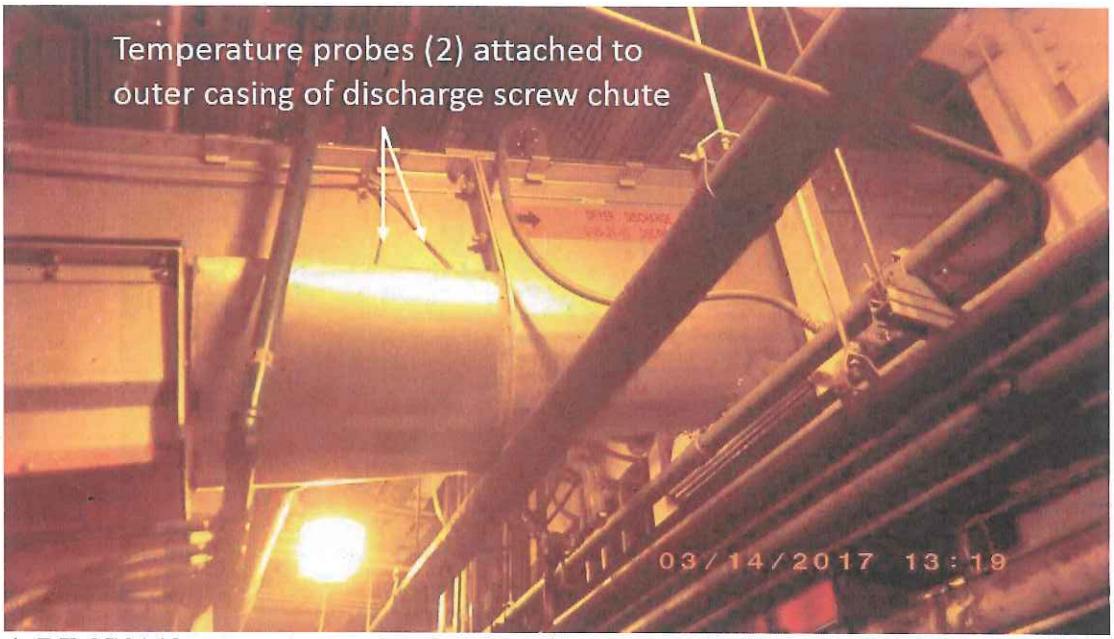


1: RIMG0136
Description: View of six of the 12 sludge rotary dryers which heat the wet filter cake.
Location: MMSD D&D Facility
Camera Direction: 87°
Date/Time: March 14, 2017; 12:55 pm.

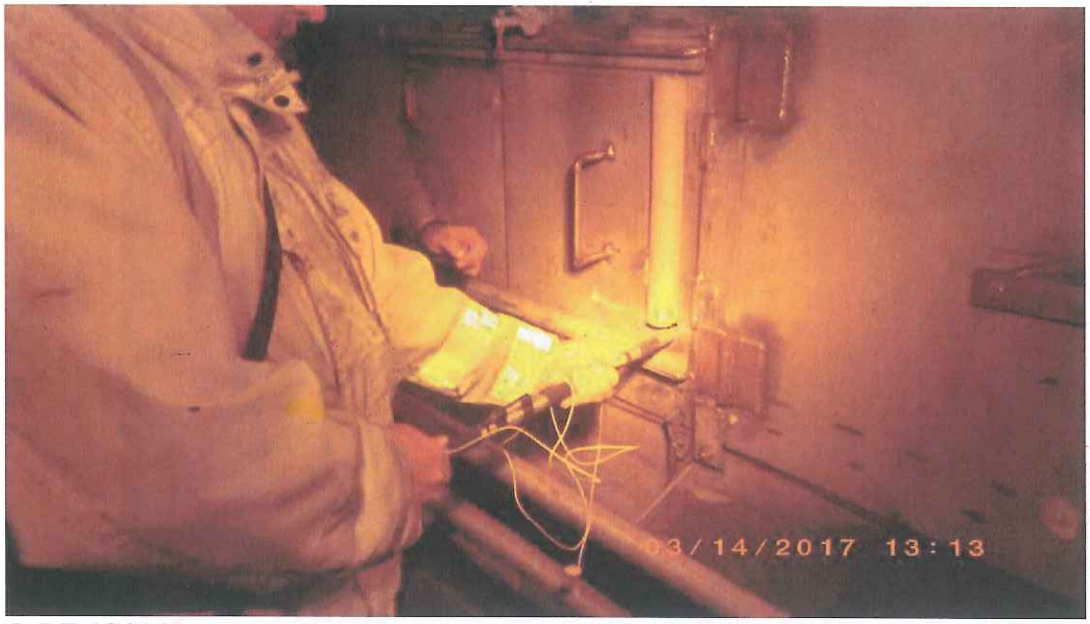
2: RIMG0139
Description: The outlet end of a sludge rotary dryer.
Location: MMSD D&D Facility
Camera Direction: 112°
Date/Time: March 14, 2017; 1:02 pm



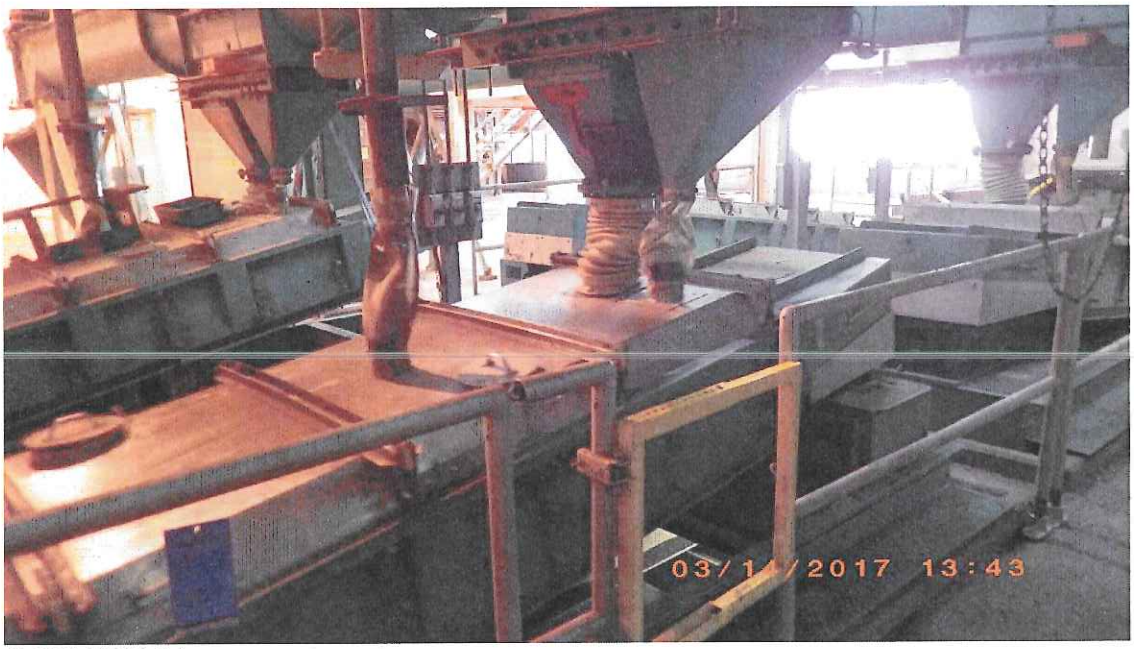
3: RIMG0140
Description: Dryer discharge chute.
Location: MMSD D&D Facility
Camera Direction: 134°
Date/Time: March 14, 2017; 1:04 pm



4: RIMG0149
Description: Dryer discharge screw chute, approximately 19 feet from dryer outlet. Note the temperature probes used by MMSD to monitor compliance with 40CFR Part 503, Appendix B (B)(2). Probes monitor temperature of the discharge screw chute outer casing.
Location: MMSD D&D Facility
Camera Direction: 296°
Date/Time: March 14, 2017; 1:19 pm



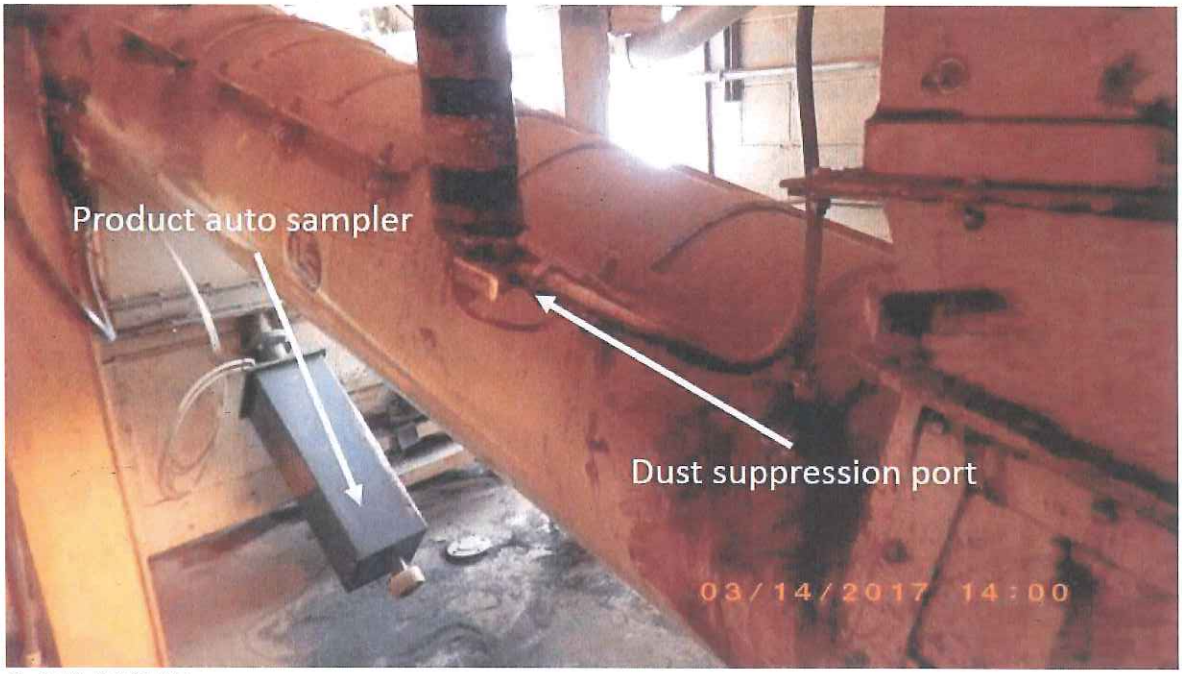
5: RIMG0147
Description: MMSD operator demonstrates the manual dryer gas temperature measurement process currently being tested by MMSD. The operator inserted the temperature probe into the sludge rotary dryer outlet access door.
Location: MMSD D&D Facility
Camera Direction: 154°
Date/Time: March 14, 2017; 1:13 pm



6: RIMG0154
Description: Screen room where final product goes through "classification" and sorted from chaff, dust, and oversized material.
Location: MMSD D&D Facility
Camera Direction: 146°
Date/Time: March 14, 2017; 1:43 pm

7: RIMG0155
Description: Final Milorganite® product sampler.
Location: MMSD D&D Facility
Camera Direction: 278°
Date/Time: March 14, 2017; 1:47 pm

8: RIMG0156
Description: Screen room. Final Milorganite® product.
Location: MMSD D&D Facility
Camera Direction: 340°
Date/Time: March 14, 2017; 1:48 pm



9: RIMG0157
Description: Belt conveyor transports product from storage silos to Load Out Facility. Note dust suppression port and product auto sampler.
Location: MMSD Load Out Facility, second floor.
Camera Direction: 245°
Date/Time: March 14, 2017; 2:00 pm